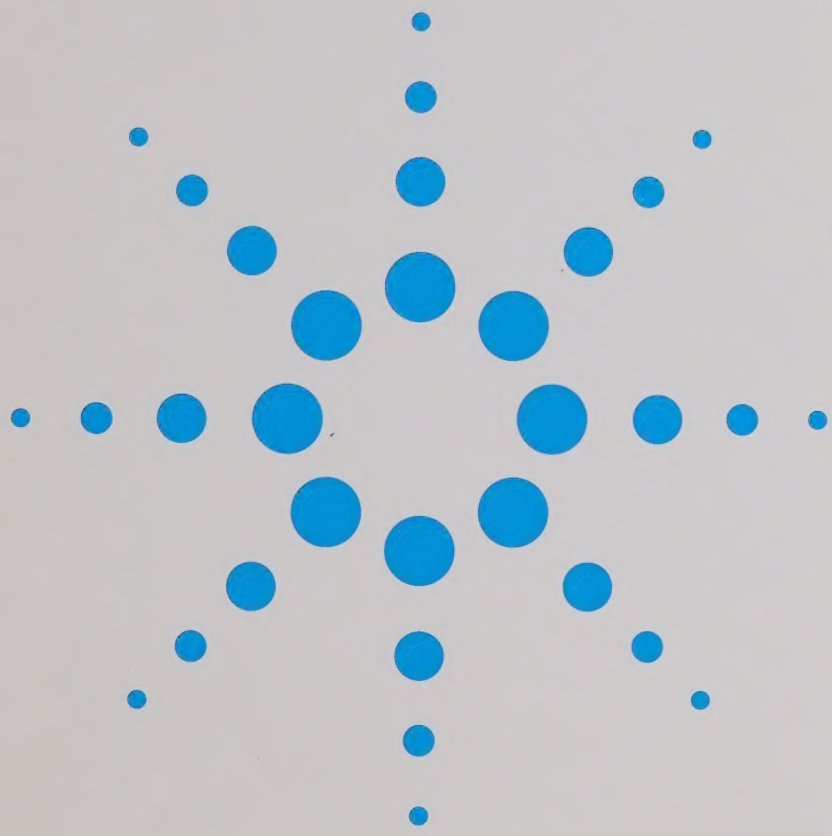

Agilent Technologies

GE Cell Site Test Software

HP 11807B Option 041 Software User's Guide

for the HP 8921A

HP Part No. 11807-90014 (Software Rev. A.01.00 and above)
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Third Edition

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Hewlett-Packard Company
Spokane Division
Learning Products Department
24001 E. Mission
Liberty Lake, WA 99019-9599
USA.

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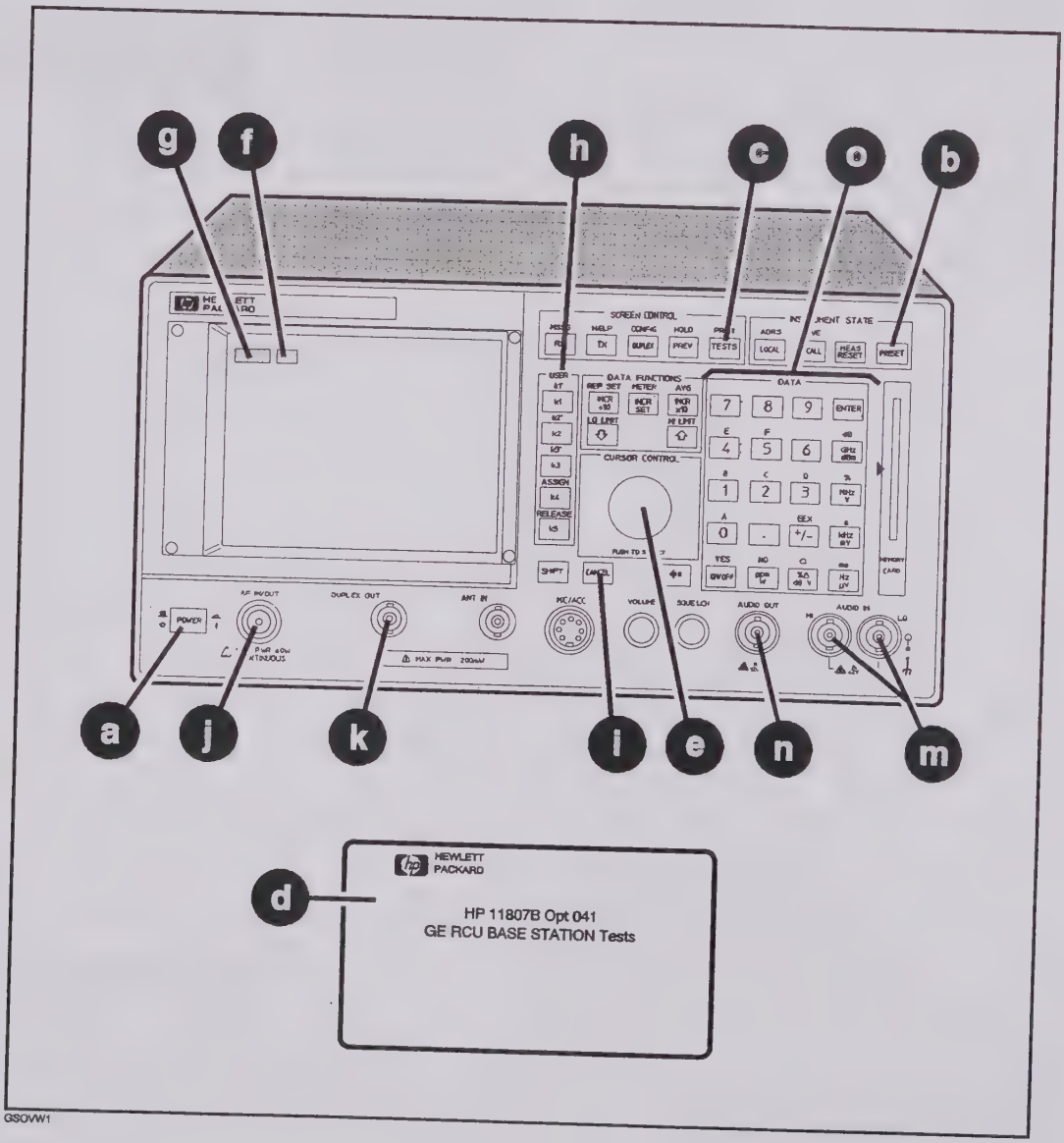
1

Getting Started

IN THIS BOOK

Five minutes with the *Getting Started* guide will steer you through autotesting the GE Extended Frequency Radio Channel Unit (RCU). You will learn, hands-on, how to use the HP 8921A and the HP 11807B Option 041 software to align and test the base station with a high probability of success. This is a quick way to get started without a lot of explanation. This guide will prepare you to use the HP 8921A User's Guide (HP Part Number 08921-90022) and the remainder of the HP 11807B Option 041 Software User's Guide (HP Part Number 11807-90014) which provide detail. Included are a glossary and a troubleshooting guide.

OVERVIEW



GSOVW1

AT A GLANCE

This is a detailed description of the important features. Step by step instructions begin on the next page.

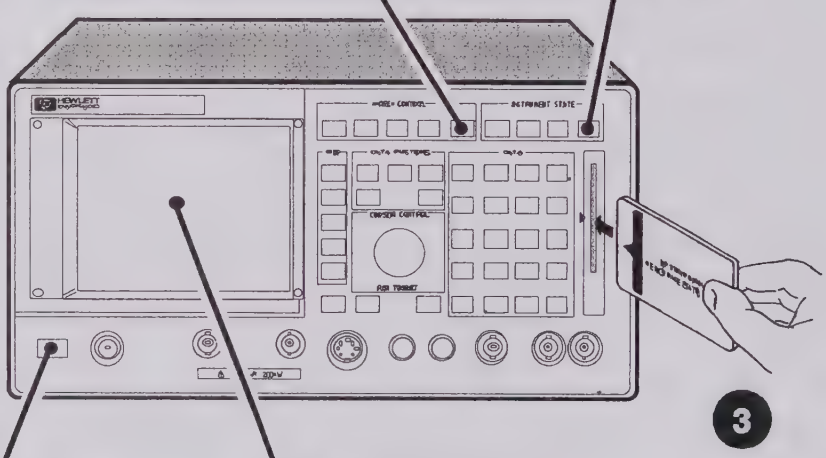
a. [POWER] key turns on the HP 8921A.
b. [PRESET] key resets all instrument settings.
c. [TESTS] key selects TESTS menu screen.
d. HP 11807B Opt 041 memory card contains GE RCU/CRCU autotest software.
e. Rotating CURSOR CONTROL knob positions the highlighted cursor. Pressing the knob selects the highlighted function.
f. **CARD** appears in the LOCATION field (contains autotest software) when selected from the Choices (**CARD**, **RAM**, **ROM**, **Disk**) field .
g. Procedure field contains the name of the test procedure currently selected. Positioning the cursor and selecting **Procedure** displays the available test procedures: **COMBINED**, **TST_NO_LB**, **GE_LCR_R1**, **GE_LCR_R2**, **COM_ALIGN**, and **SYS_ALIGN** in the Choices field. Positioning the cursor and selecting **COMBINED**, displays **COMBINED** in the Procedure field.
h. USER keys ([k1] through [k5]) allow a one keystroke selection of a numbered operation (**Run**, **Continue**, **Edit**) in the Action field. Pressing [k1] begins the **COMBINED** autotest procedure; it takes approximately two minutes for the software to load.
i. Pressing the [CANCEL] key pauses the internal IBASIC program (runs after selecting **Run Test**) so that the keyboard and menu functions become operable.
j. Cable the HP 8921A RF IN/OUT connector to the transmitter output.
k. HP 8921A DUPLEX OUT connector feeds to RX1 or RX2 on the RCU.
l. RJ-11 connector (not shown) is located on back panel of HP 8921A and connects through a DB-25 connector to J4 of audio bd GE_RCU.
m. HP 8921A AUDIO IN connects to base station PSDP AUDIO OUT EQPT JACK.
n. HP 8921A AUDIO OUT connects to base station PSDP AUDIO IN EQPT JACK.
o. DATA keys are used to modify values for specifications, parameters, etc.

A. POWER-ON AND SET-UP THE HP 8921A

Do steps 1-5 in numbered order.

(If after step 5 the screen looks as shown on FIGURE 5, set-up is complete.)

(PRESET is a reset command that can be used at any time to start from the beginning.)



5 *PRESS TESTS*

4 *PRESS PRESET*

1 *PRESS POWER*

2 *Wait about 20 sec. for a display to appear, then go to step 3.*

3 *INSERT CARD HP 11807B Opt 041*

GSLOAD1

Next: Turn page to list procedures on the Memory Card

When you see this screen, turn the page and continue.

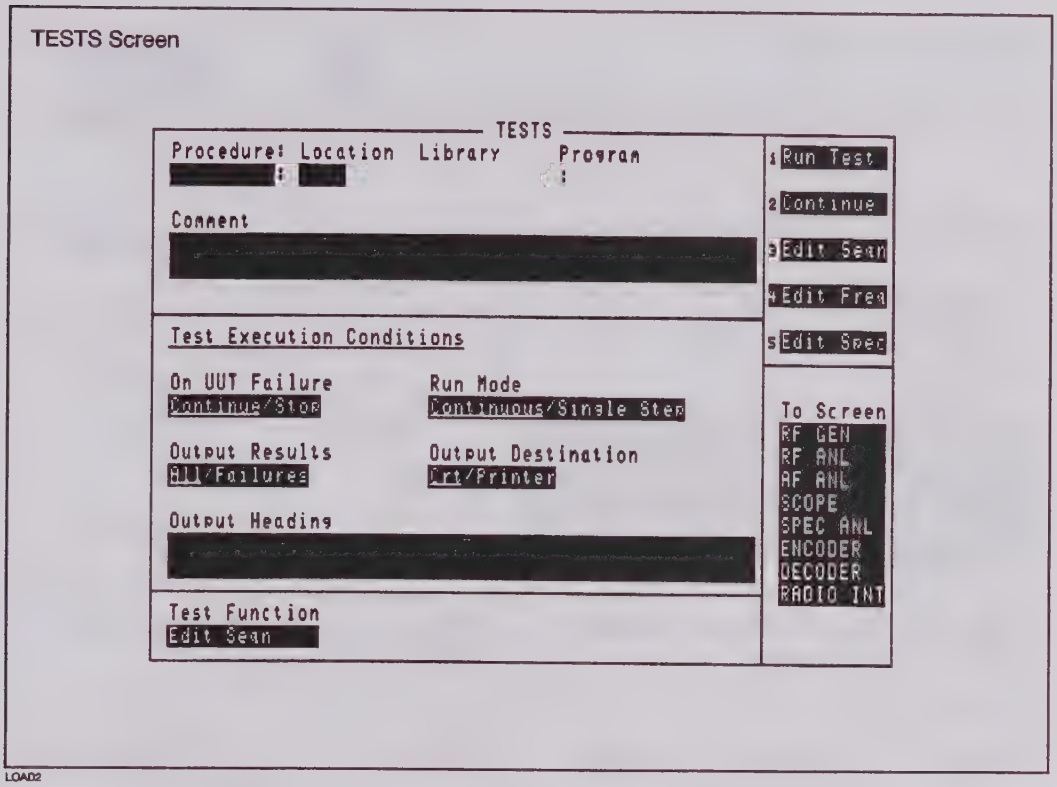


FIGURE 1

ARE YOU STUCK?

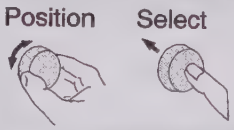
IF YOU DO NOT SEE THE ABOVE SCREEN AFTER COMPLETING STEP #5, REPEAT STEPS #4 AND #5.

The TESTS key displays the menu screen shown which allows access to the various test procedures. The HP 11807B Option 041 memory card has factory set SPECifications and PARaMeter values; to edit these values, see tasks I, J and K , and Modifying Tests task H.

B. LIST TEST PROCEDURES ON THE MEMORY CARD

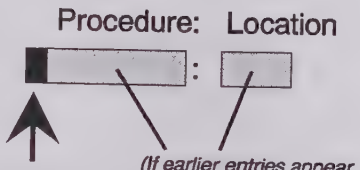
Follow numbered steps ➡

Use the cursor control knob on front panel to position the cursor and make selections.

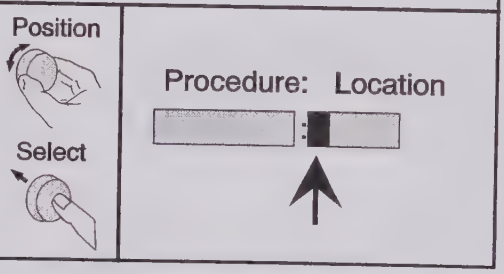


Use FIGURE-2 on next page for reference.

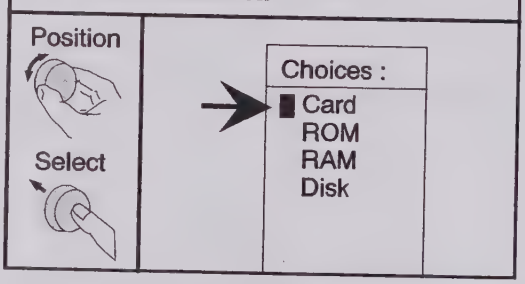
1 ***Note cursor is positioned at*** Procedure.



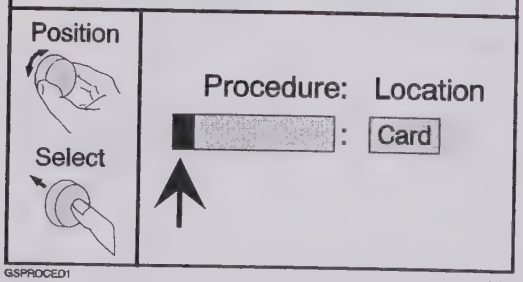
2 ***Position cursor at*** Location ***and select it.***



3 ***Position cursor at*** Card ***and select it.***

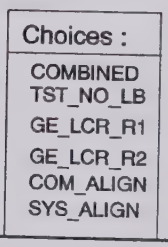


4 ***Position cursor at*** Procedure ***and select it.***



GSPROCED1

5 ***The*** Choices: ***menu should now appear as shown.***



Next: Turn page to select and run the desired procedure

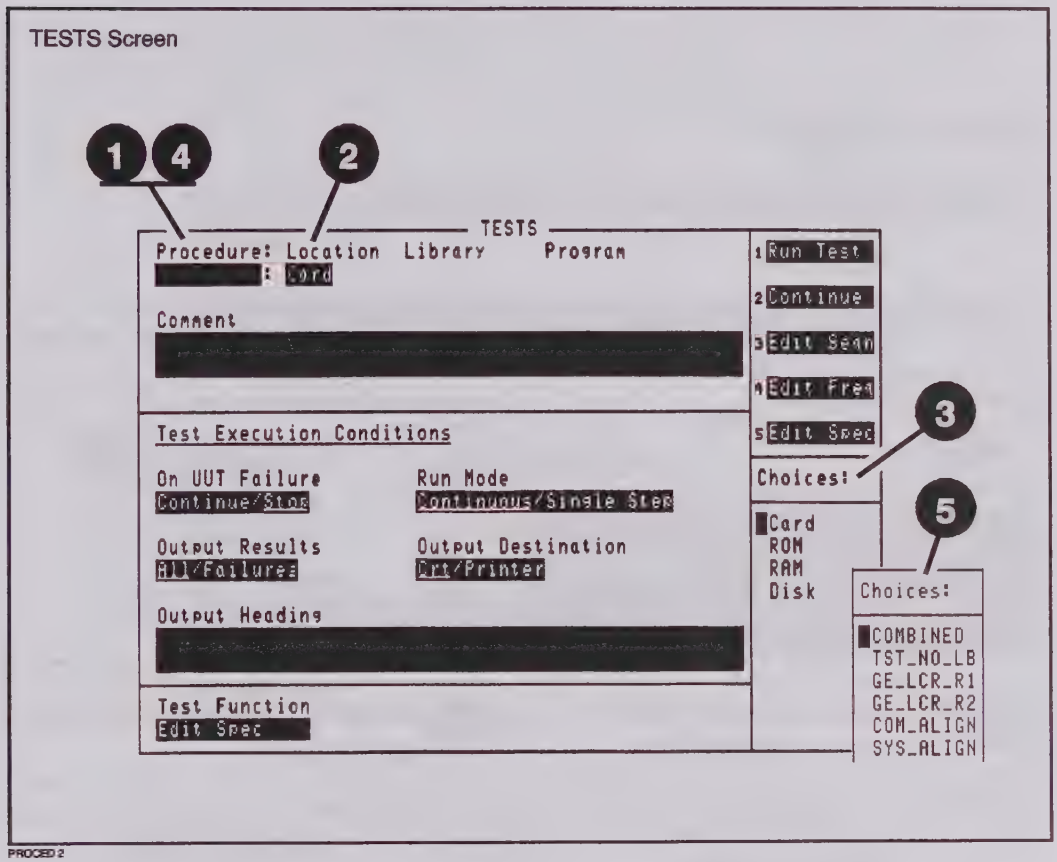


FIGURE 2

ARE YOU STUCK?

If you do not see the screen displayed above after completing step #4, go back to task A, Step #4, PRESET, and repeat everything to this point.

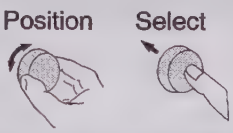
CAUTION! DO NOT PRESS THE KNOB WHILE ROTATING AND DO NOT ROTATE THE KNOB WHILE PRESSING IT OR YOU MAY SELECT INCORRECTLY.

This page provides a visual reference for the numbered activities. Selecting LOCATION allows access to the choices of where the test procedure is stored: ROM, RAM, CARD, or Disk. Selecting CARD prepares the HP 8921A to query the CARD for its available test procedures.

C. SELECT AND RUN AUTOTEST PROCEDURE

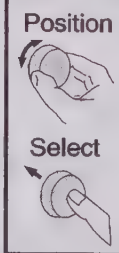
Follow numbered steps ➡

Use the cursor control knob on front panel to position the cursor and make selections.



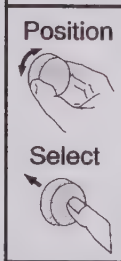
Use FIGURE-3 on next page for reference.

1 ***Position cursor at*** COMBINED ***and select it.***



Choices :
- COMBINED
- TST_NO_LB
- GE_LCR_R1
- GE_LCR_R2
- COM_ALIGN
- SYS_ALIGN

2 ***Position cursor at*** On UUT Failure ***and select*** Stop.

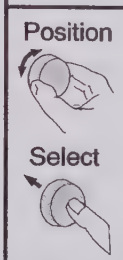


On UUT Failure

Continue/Stop

(The underline indicates which option is selected, pressing knob changes the selection.)

3 ***Position cursor at*** Run Test ***and select it.***



- Run Test
- 2 Continue
- 3 Edit Seqn
- 4 Edit Freq
- 5 Edit Spec

4 ***The*** COMBINED ***test takes approx. 2 min. to load.***

When loading is done the INITIAL SET UP FOR TESTING *screen will appear on display.*

.SEL-RUN1

Stop **IMPORTANT !**

Illustrations shown in the following SET UP THE RCU FOR TESTING *instructions are to be used for visual reference only. In order to successfully complete testing, you must read and perform the instructions provided on the instrument's display.*

Next: Turn page to set-up and connect the RCU

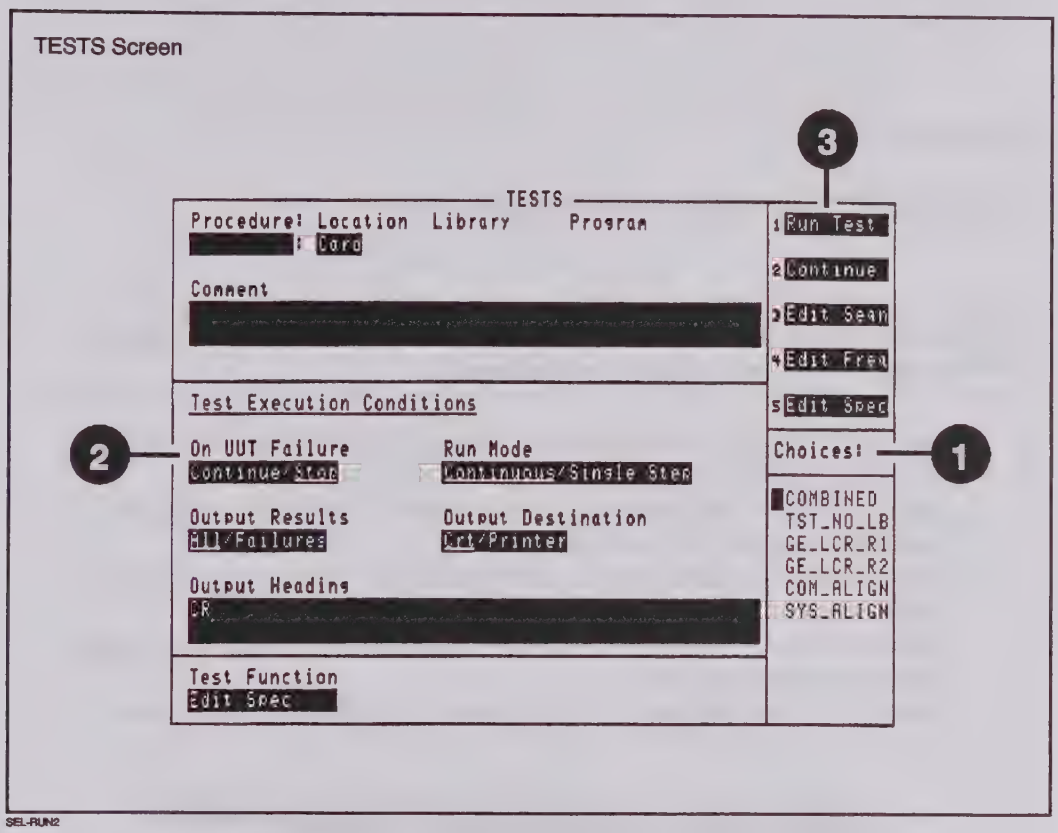


FIGURE 3

ARE YOU STUCK?

If you need to start over, go back to task A, step #4, preset, and repeat everything to this point.

Selecting RUN TEST begins the autotest procedure; the HP 8921A may require up to two minutes to load the software the first time the CARD is installed ... be patient and wait for screen 1 of task D to appear.

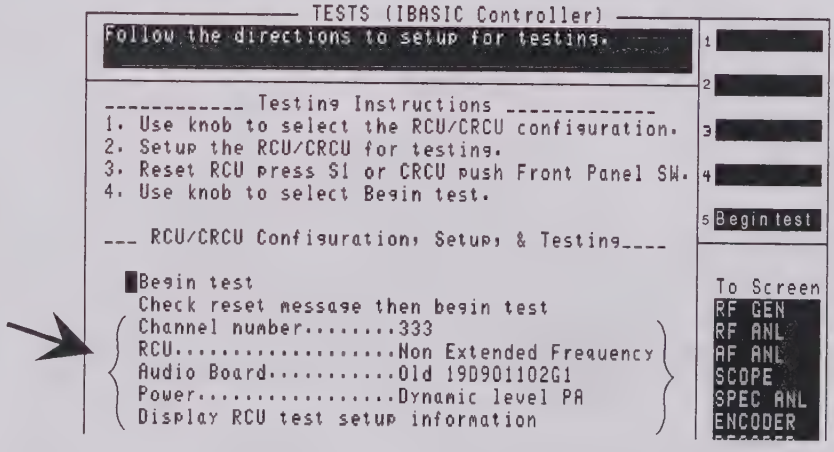
Highlighting and selecting the Procedure field displays COMBINED, TST_NO_LB, GE_LCR_R1, GE_LCR_R1, COM_ALIGN, and SYS_ALIGN as options in the Choices field.

A complete description of these tests may be found in chapter 4 of the HP 11807B Option 041 Software User's Guide. Select the COMBINED test procedure; it combines all of these tests and alignments in an optimal sequence to reduce maintenance time.

D. SET-UP THE RCU FOR TESTING

1 ***Follow the instructions below for*** **Channel number, RCU type, Audio board** ***and*** **Power** ***selections.***

1. Position cursor at **Chanel number** and press knob. Use keys on instrument front panel to enter desired channel number, then press knob.
2. Position cursor at **RCU** and select **Extended Frequency.** Press knob to toggle between availible choices.
3. Position cursor at **Audio board** and make desired selection. Press knob to toggle between availible choices.
4. Position cursor at **Power** and make desired selection, Press knob to toggle between availible choices.
5. Position cursor at **Display RCU test setup information** and press knob.



RCU-SU5

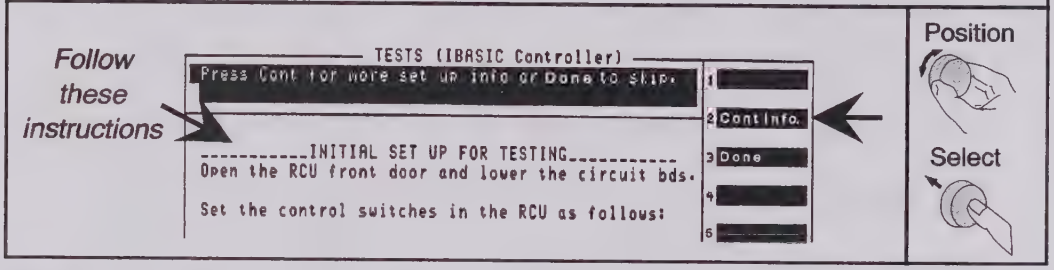
Next: Turn page to continue

ARE YOU STUCK?

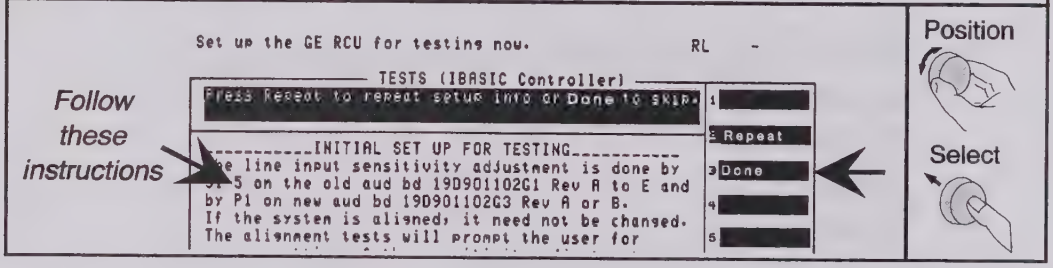
- IF YOU DO NOT SEE THE SCREEN DISPLAYED ON THE PRECEDING PAGE, GO BACK TO TASK A, STEP #4 AND REPEAT ALL (see task M, Trouble Check). You may leave all the cables connected.
- As shown in figure 4, RJ-11 is a six-pin type; the DB-25 connector is specially wired; be sure to use the one marked "TRANSCEIVER".

D. SET-UP THE RCU FOR TESTING (continued)

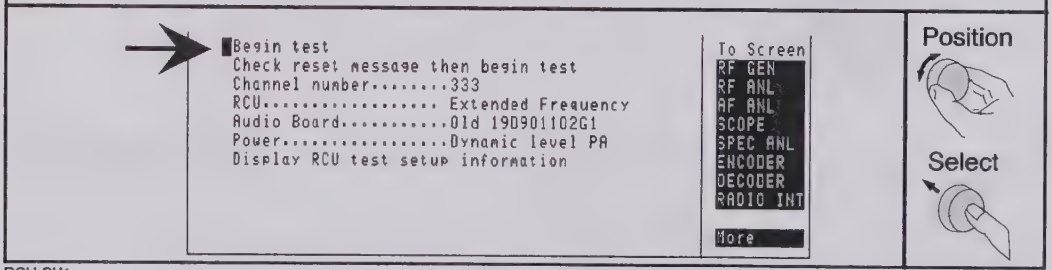
2 ***A. Follow*** INITIAL SET UP FOR TESTING ***instructions.***
B. Position cursor at Cont. Info. ***and select it.***



3 ***A. Continue*** INITIAL SET UP FOR TESTING. ***(See FIGURE 4, next page)***
B. Position cursor at Done ***and select it.***


Set up the GE RCU for testing now.
RL -
Follow these instructions
TESTS (IBASIC Controller)
Press Repeat to repeat setup info or Done to skip.
1
2 Repeat
3 Done
4
5
----------INITIAL SET UP FOR TESTING----------
line input sensitivity adjustment is done by
5 on the old aud bd 19D901102G1 Rev A to E and
by P1 on new aud bd 19D901102G3 Rev A or B.
If the system is aligned, it need not be changed.
The alignment tests will prompt the user for
Position
Select

4 ***Position cursor at*** Begin test ***and select it, then continue on next page.***



RCU-SU1

Next: Turn page and proceed with autotest

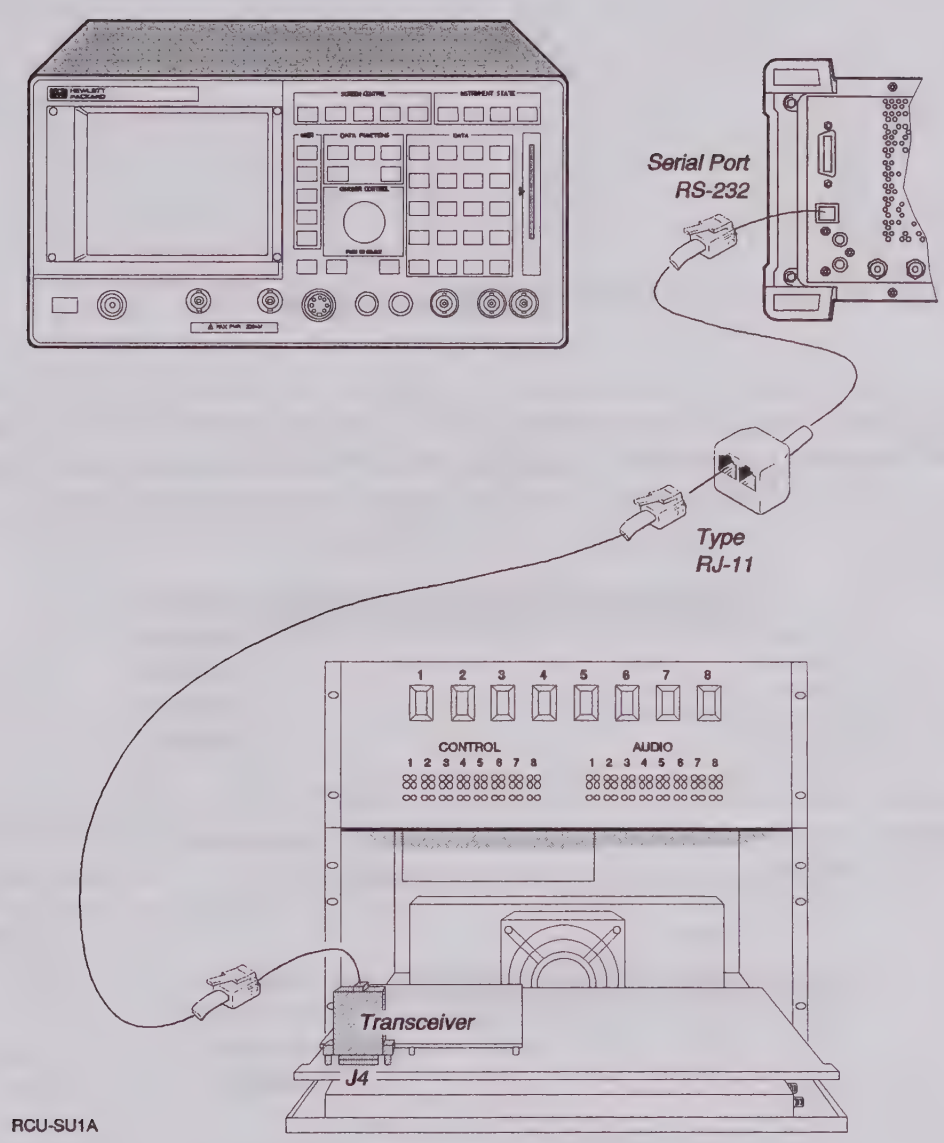
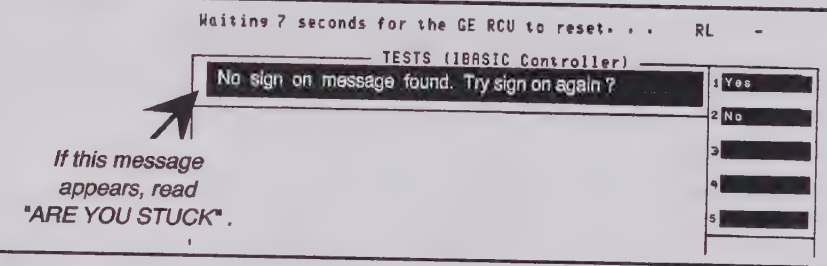

Serial Port
RS-232
Type
RJ-11
1 2 3 4 5 6 7 8
CONTROL
1 2 3 4 5 6 7 8
AUDIO
1 2 3 4 5 6 7 8
Transceiver
J4
RCU-SU1A

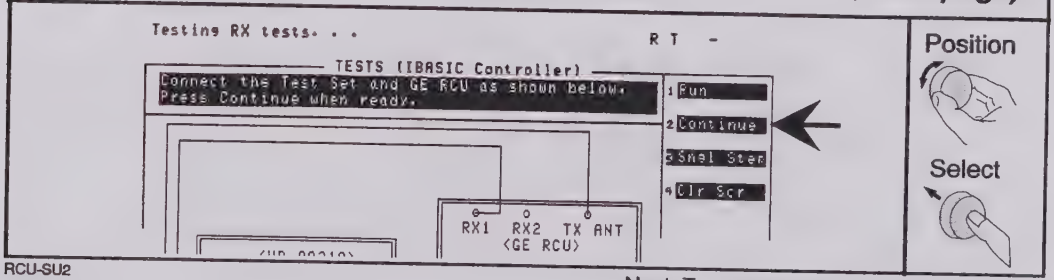
FIGURE 4

D. SET-UP THE RCU FOR TESTING (continued)

5 ***If the*** Waiting 7 seconds for GE RCU to reset ***screen stays on your display longer than 7 seconds with the following message, read "ARE YOU STUCK" at bottom of page, otherwise go to step 6.***


Waiting 7 seconds for the GE RCU to reset. . . RL -
TESTS (IBASIC Controller)
No sign on message found. Try sign on again ?
1 Yes
2 No
3
4
5
If this message appears, read "ARE YOU STUCK".

6 ***A. Connect the Test Set and the GE RCU as shown.*** ***(See FIGURE 5, next page)***
B. Position cursor at Continue ***and select it.***



RCU-SU2

Next: Turn page and proceed with autotest

ARE YOU STUCK?

IF THIS SCREEN REMAINS FOR GREATER THAN 7 SECONDS AND "No sign on message found ... " appears, DO NOT PROCEED. Any one of the following may be the problem: 1. Failure to press the System Reset (S1) as described in task D, Steps #1 and #2. 2. RS-232 is improperly cabled (RJ-11 is 6 pin; DB-25 must be wired properly; marked TRANSCEIVER). See figure 1 and TROUBLE CHECK. 3. The G.E. RCU is failing to respond to RS-232. 4. The HP 8921A RS-232 is not working properly.

To restart, go back to task A, Step #4, PRESET, and repeat all.

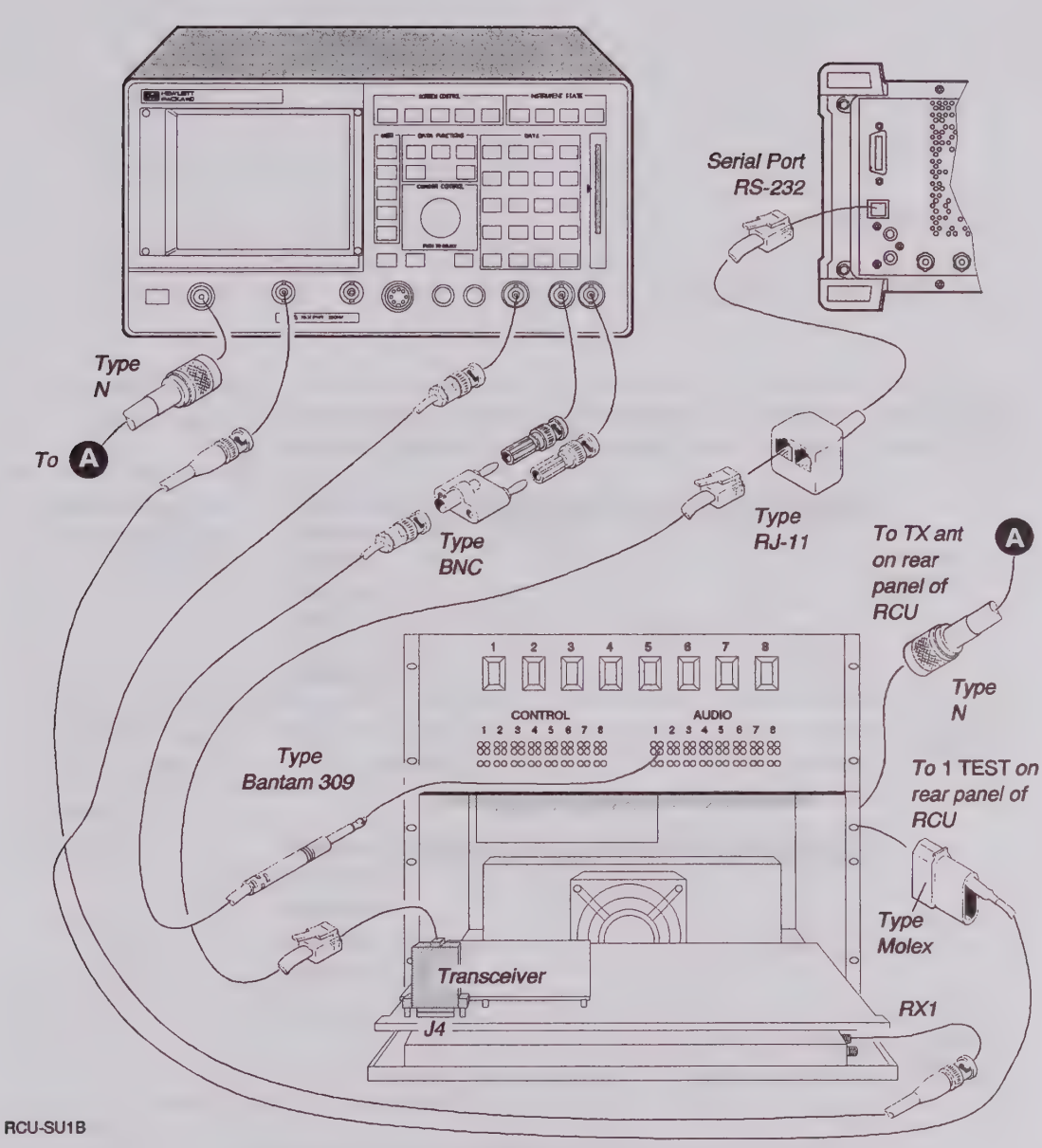
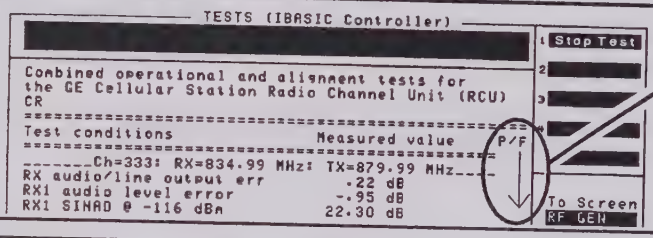

Serial Port
RS-232
Type
N
To A
Type
BNC
Type
RJ-11
To TX ant
on rear
panel of
RCU
A
Type
N
1 2 3 4 5 6 7 8
CONTROL
1 2 3 4 5 6 7 8
AUDIO
1 2 3 4 5 6 7 8
Type
Bantam 309
To 1 TEST on
rear panel of
RCU
Type
Molex
Transceiver
J4
RX1
RCU-SU1B

FIGURE 5

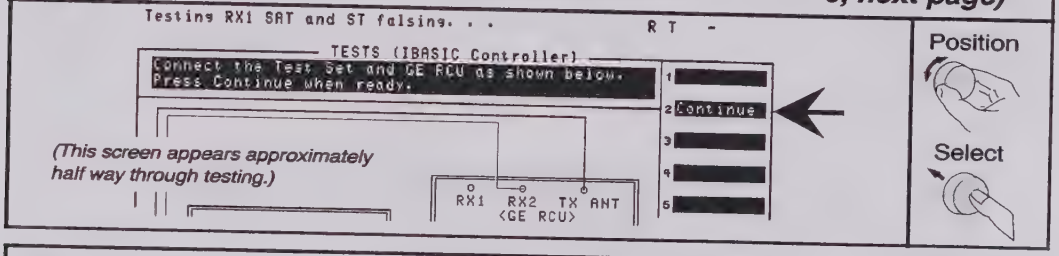
E. TESTING THE RCU

7 ***The COMBINED operational alignment tests are now running, test results should appear on the display screen.***

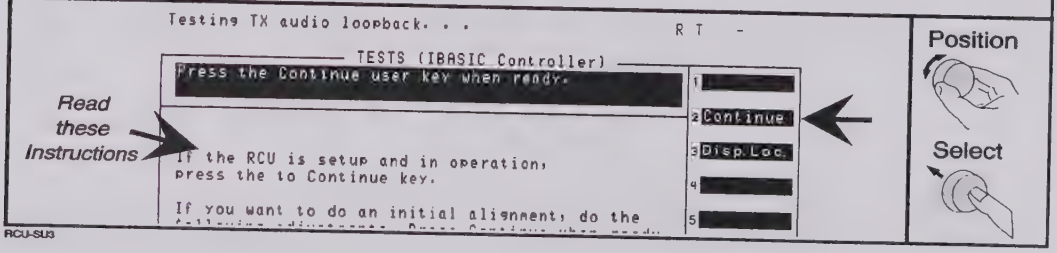

TESTS (IBASIC Controller)
Stop Test
Combined operational and alignment tests for the GE Cellular Station Radio Channel Unit (RCU)
CR
Test conditions
Measured value
P/F
Ch=333: RX=834.99 MHz: TX=879.99 MHz
RX audio/line output err -.22 dB
RX1 audio level error -.95 dB
RX1 SINAD @ -116 dBm 22.30 dB
To Screen
RF GEN

If F appears in this column, program has Stopped On Failure ; ***Go to Task G.***

8 ***A. When this screen appears, reconnect as shown. (See FIGURE 6, next page)***
B. Position cursor at Continue ***and select it.***


Testing RX1 SAT and ST falsing. . .
R T -
TESTS (IBASIC Controller)
Connect the Test Set and GE RCU as shown below.
Press Continue when ready.
Continue
(This screen appears approximately half way through testing.)
RX1 RX2 TX ANT
(GE RCU)
Position
Select

9 ***A. Read the instructions on the display.***
B. Position cursor at Continue ***and select it.***


Testing TX audio loopback. . .
R T -
TESTS (IBASIC Controller)
Press the Continue user key when ready.
Read these Instructions
If the RCU is setup and in operation, press the to Continue key.
If you want to do an initial alignment, do the
Continue
Disp.Loc.
Position
Select
RCU-SUB

ARE YOU STUCK?

If you need to restart, go back to task A, step #4, PRESET, and repeat all (see task M, Trouble Check). To stop and make every adjustment, set parm #4, value 2 (see task K). Alternatively, to select Continue, press USER key k2 (the numbered USER keys, k1 through k5, select the respective numbered function in the action field).

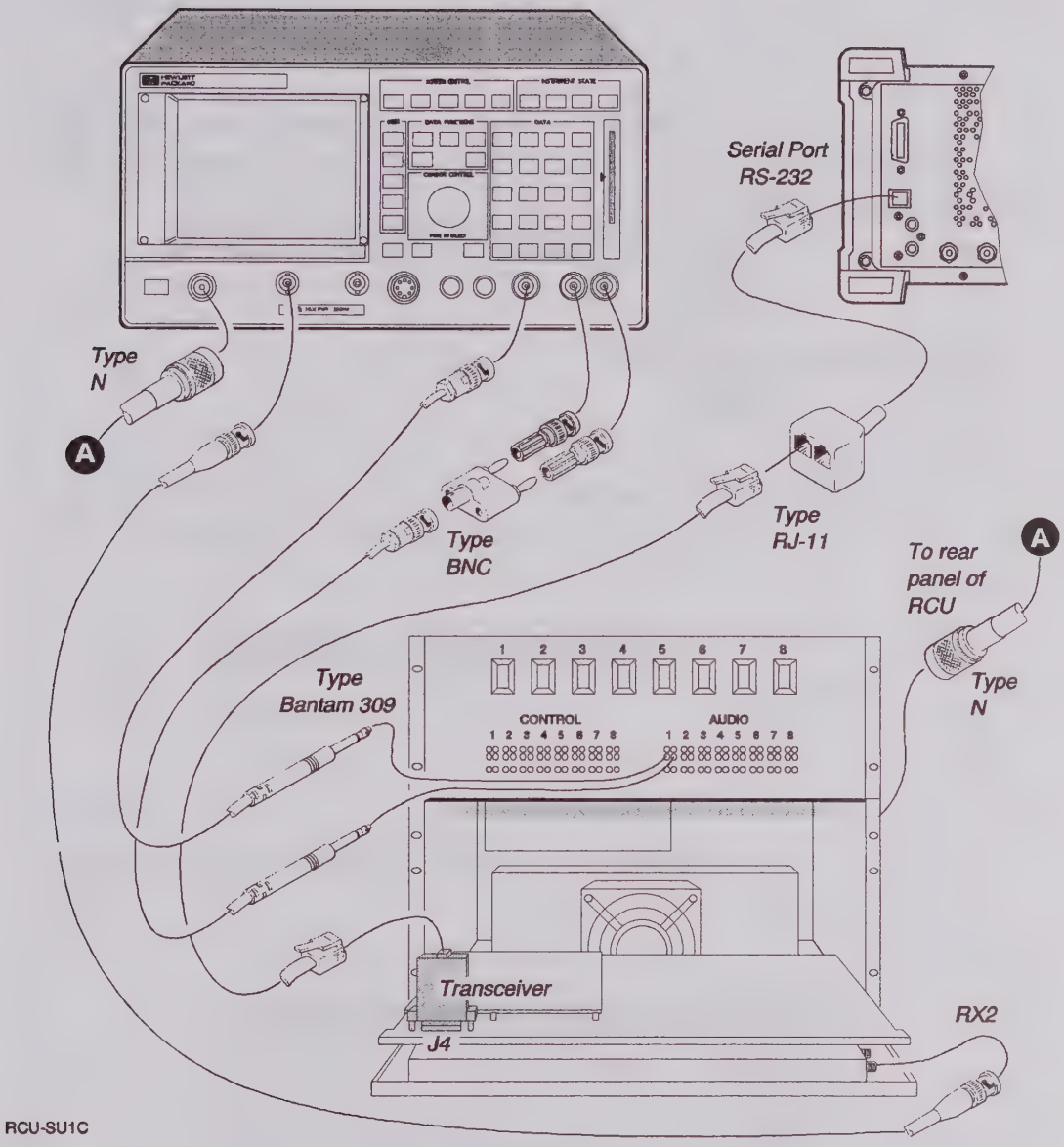
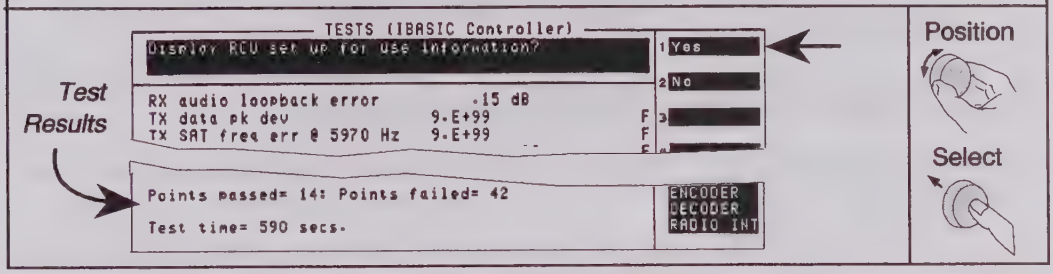

Serial Port
RS-232
Type
N
A
Type
BNC
Type
RJ-11
To rear
panel of
RCU
A
Type
Bantam 309
1 2 3 4 5 6 7 8
CONTROL
1 2 3 4 5 6 7 8
AUDIO
1 2 3 4 5 6 7 8
Type
N
Transceiver
J4
RX2
RCU-SU1C

FIGURE 6

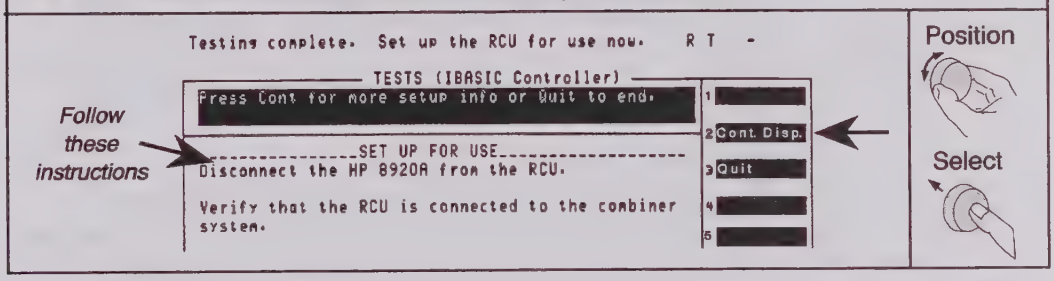
This page intentionally left blank.

F. SET UP THE RCU FOR USE

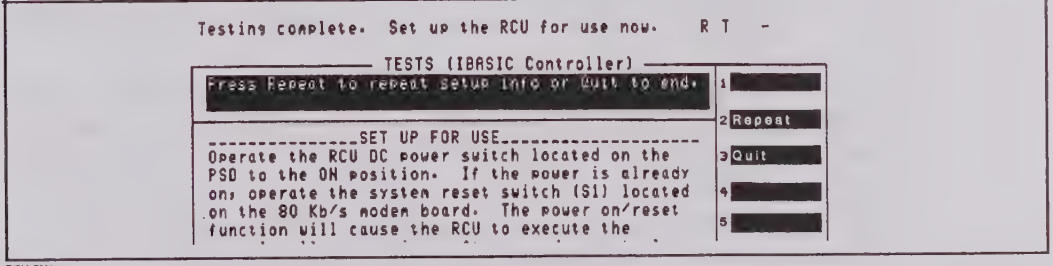
8 ***When this screen appears testing is complete, position cursor and select*** Yes ***to display RCU*** SET UP FOR USE ***information.***



9 ***A. Follow the*** SET UP FOR USE ***instructions on the display.***
B. Position cursor at Continue Disp ***and select it.***


Testing complete. Set up the RCU for use now. R T -
TESTS (IBASIC Controller)
Press Cont for more setup info or Quit to end.
Follow these instructions
SET UP FOR USE
Disconnect the HP 8920A from the RCU.
Verify that the RCU is connected to the combiner system.
1
2 Cont. Disp.
3 Quit
4
5
Position
Select

10 ***Complete the*** SET UP FOR USE ***instructions.***


Testing complete. Set up the RCU for use now. R T -
TESTS (IBASIC Controller)
Press Repeat to repeat setup info or Quit to end.
SET UP FOR USE
Operate the RCU DC power switch located on the PSD to the ON position. If the power is already on, operate the system reset switch (S1) located on the 80 Kb/s modem board. The power on/reset function will cause the RCU to execute the
1
2 Repeat
3 Quit
4
5

RCU-SU4

G. AUTOTESTING STOPPED ON FAILURE

The program has stopped and you see an F in the P/F column or a meter on the screen. NOW WHAT??? There are several ways to proceed:

a. If you only want to see test results, position the cursor and select Continue (screen A, opposite page)..THEN..if a meter appears on the screen, position cursor and select Take It (or press k1) - screen B, opposite page.
b. To verify the source of the problem:
   i. Does test procedure COMBINED have correct SPECification and PARaMeter values? See *Changing Pass/Fail Limits, Test Environment Conditions ...* , chapter 3, HP 11807B Opt 041 Software Reference Guide.
   ii. Are all cables connected properly?
   iii. Have you followed all alignment, cabling, and setup procedures?
   iv. Assuming the GE RCU is the source of failure and a meter appears on screen (see B, opposite page), there is an associated adjustment.
      1) Position cursor and select Disp Loc (or press k4). A diagram appears displaying location and designator of component to be adjusted (see C, opposite page).
      2) Position cursor and select Continue (or press k2) to display meter again.
      3) Adjust component indicated (such as A3 R43) on screen until needle resides between the two large graticule marks as shown in screen B, opposite page (see this test in user's guide).
      4) When screen is out of view, bursting audible tone may be used for adjustment (for greater volume, press k4, TNS LOUD).
         a) Failure below SPEC lower limit value - tone is 100 Hz.
         b) Failure between SPEC lower limit value and optimum - tone is 500 Hz.
         c) Failure between SPEC upper limit and optimum - tone is 1.5 kHz.
         d) Failure above SPEC upper limit value - tone is 3000 Hz.
         e) Duration of tone burst increases with adjustment error.
         f) If no meter appears, the measurement falls outside SPEC value limits and there is no associated adjustment. Troubleshooting to failed component is necessary.
         g) Is the HP 8921A working properly? The HP 8921A has self-test, see user's guide.

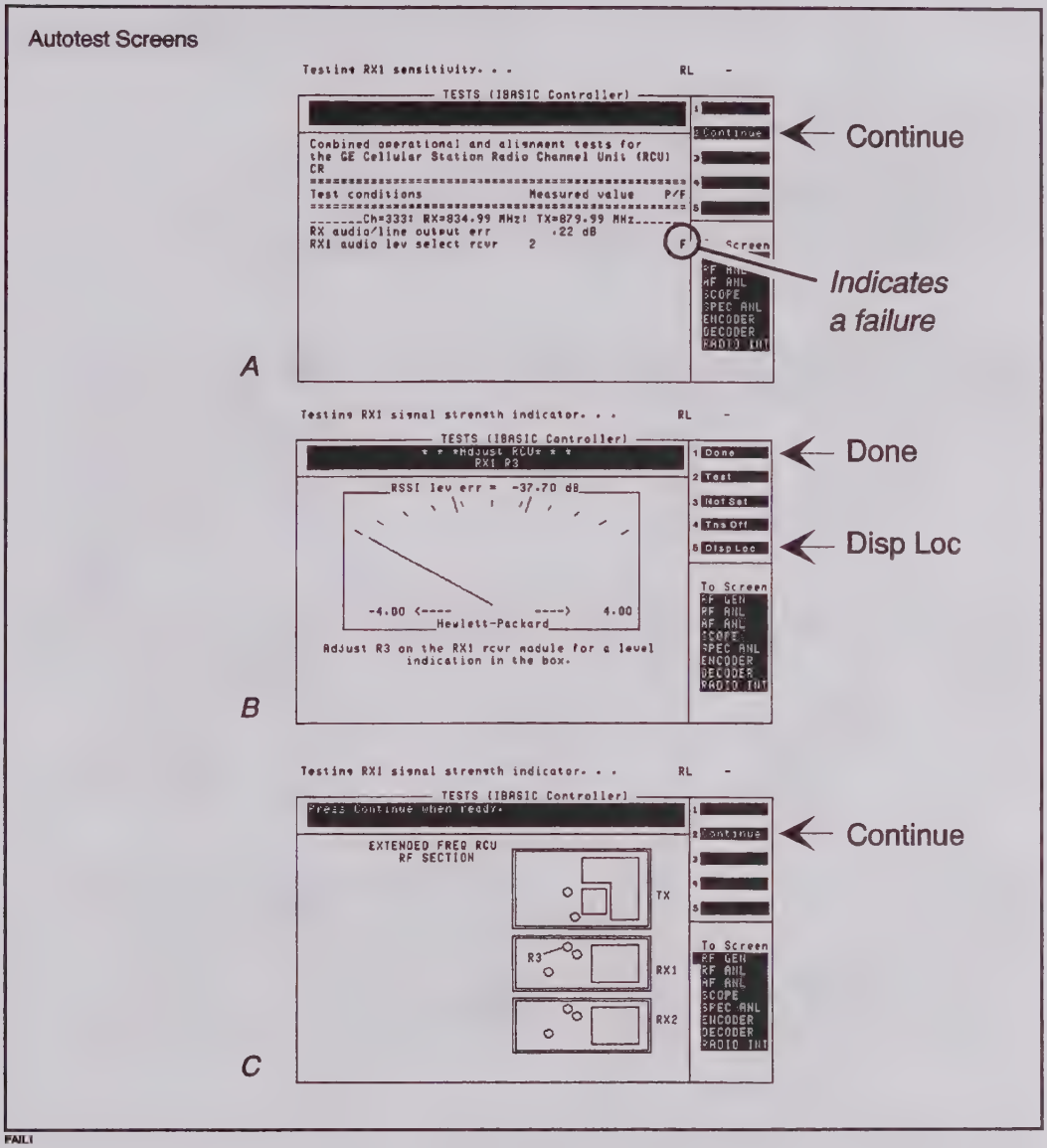
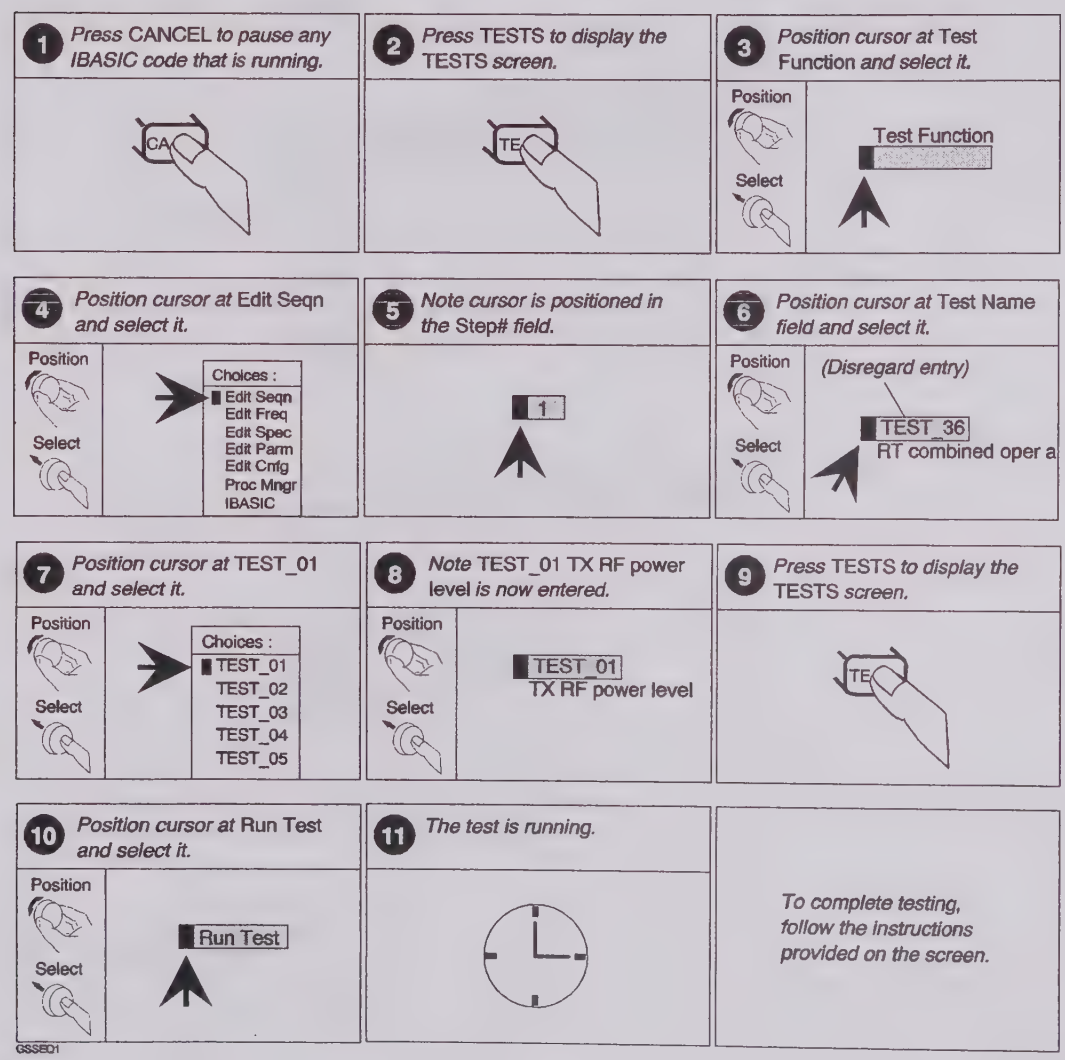

Autotest Screens
Testing RX1 sensitivity. . .
TESTS (IBASIC Controller)
Continue
Combined operational and alignment tests for
the GE Cellular Station Radio Channel Unit (RCU)
CR
Test conditions
Measured value
P/F
Ch=333 RX=834.99 MHz TX=879.99 MHz
RX audio/line output err
.22 dB
RX1 audio lev select rcvr
2
F
Screen
RF ANL
MF ANL
SCOPE
SPEC ANL
ENCODER
DECODER
RADIO INT
Continue
Indicates
a failure
A
Testing RX1 signal strength indicator. . .
TESTS (IBASIC Controller)
* * *Adjust RCU* * *
RX1 R3
RSSI lev err = -37.70 dB
-4.00 <----
----> 4.00
Hewlett-Packard
Adjust R3 on the RX1 rcvr module for a level
indication in the box.
1 Done
2 Test
3 Not Set
4 Tns Off
5 Disp Loc
To Screen
RF GEN
RF ANL
MF ANL
SCOPE
SPEC ANL
ENCODER
DECODER
RADIO INT
Done
Disp Loc
B
Testing RX1 signal strength indicator. . .
TESTS (IBASIC Controller)
Press Continue when ready.
EXTENDED FREQ RCU
RF SECTION
TX
R3
RX1
RX2
Continue
C
FAIL!

FIGURE 7

H. SINGLE MEASUREMENT EXAMPLE: Making a TX RF Power Level Measurement



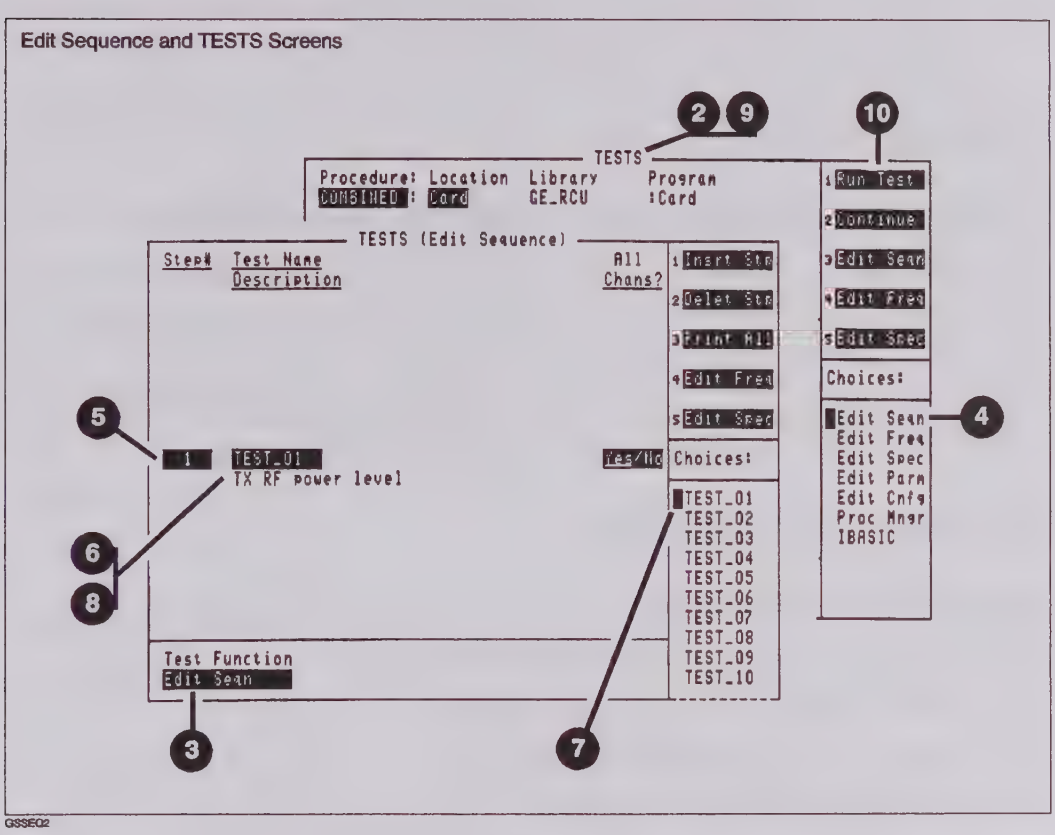


FIGURE 8

If you only have to make one measurement, e.g. TX Power, it is much faster to be able to select, run, and repeat this measurement without having to go through the whole COMBINED procedure. Press the CANCEL key to pause any IBASIC code that may be running. Then press TESTS key to access the Test Function field and select Edit Seq (edit sequence). Clear the displayed tests by selecting Delete Stp (k2) several times. Selecting the Test Name field now allows scrolling through the test descriptions to find the desired measurement, e.g. TEST_01 (TX RF power level). THIS SINGLE MEASUREMENT WILL REMAIN UNTIL YOU SELECT A NEW PROCEDURE. For more details on making and saving test sequences, see chapter 3 of HP 11807B Opt 041 Software Reference Guide.

I. Required Parameter and Specification Changes

When you are ready to begin performing tests on your base station, there are several parameters and two specifications which must be set to match your system requirements. The next two task modules, J and K, will describe how to change parameter and specification values. For more details on the specific parameters and specifications, see *Testing Philosophy*, *Parameter Descriptions*, and *Specification Descriptions* in chapter 4 of this User's Guide.

Required Parameter Changes

System Audio Level Parameters

- RX audio out CRCU LINE OUTPUT LEVEL (LOL)
- RX audio out RCU OUTPUT TEST LEVEL (OTL)
- TX audio in CRCU LINE INPUT LEVEL (LIL)
- TX audio in RCU INPUT TEST LEVEL(ITL)

System Deviation Parameters

- RX standard CRCU test level deviation
- RX standard RCU test level deviation

Test Bus Level Parameters

- RX audio test input lev for CRCU std dev
- RX audio test input lev for RCU std dev

Required Specification Changes

System Deviation Specifications

- TX voice deviation @ CRCU LINE INPUT LEVEL
- TX voice deviation @ RCU INPUT TEST LEVEL

Recommended Parameter Changes

When you are ready to begin performing tests on your base station, there are several parameters which we recommend to set to match your system requirements. The next two task modules, J and K, will describe how to change parameter and specification values. For more details, see *Testing Philosophy*, *Parameter Descriptions*, and *Specification Descriptions* in chapter 4 of this User's Guide.

Power Level Parameters

- `TX power high level 0-7`
- `TX power low level 0-7`

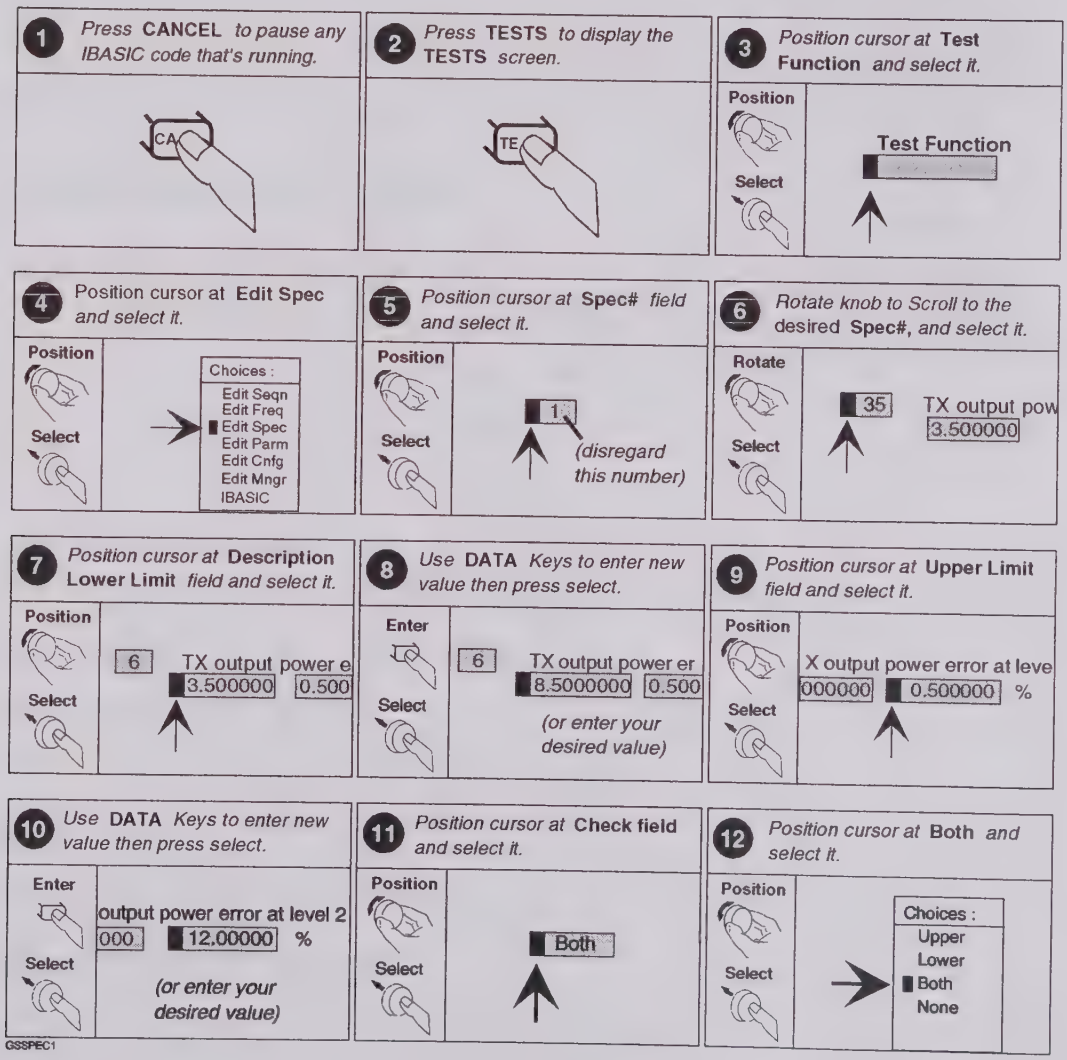
Path Loss Parameters

- `RX1 path loss`
- `RX2 path loss`
- `TX path loss`

RSSI offset Parameter

- `RX RSSI offset`

J. CHANGE SPECIFICATION VALUE EXAMPLE: Changing TX Power Specification Values



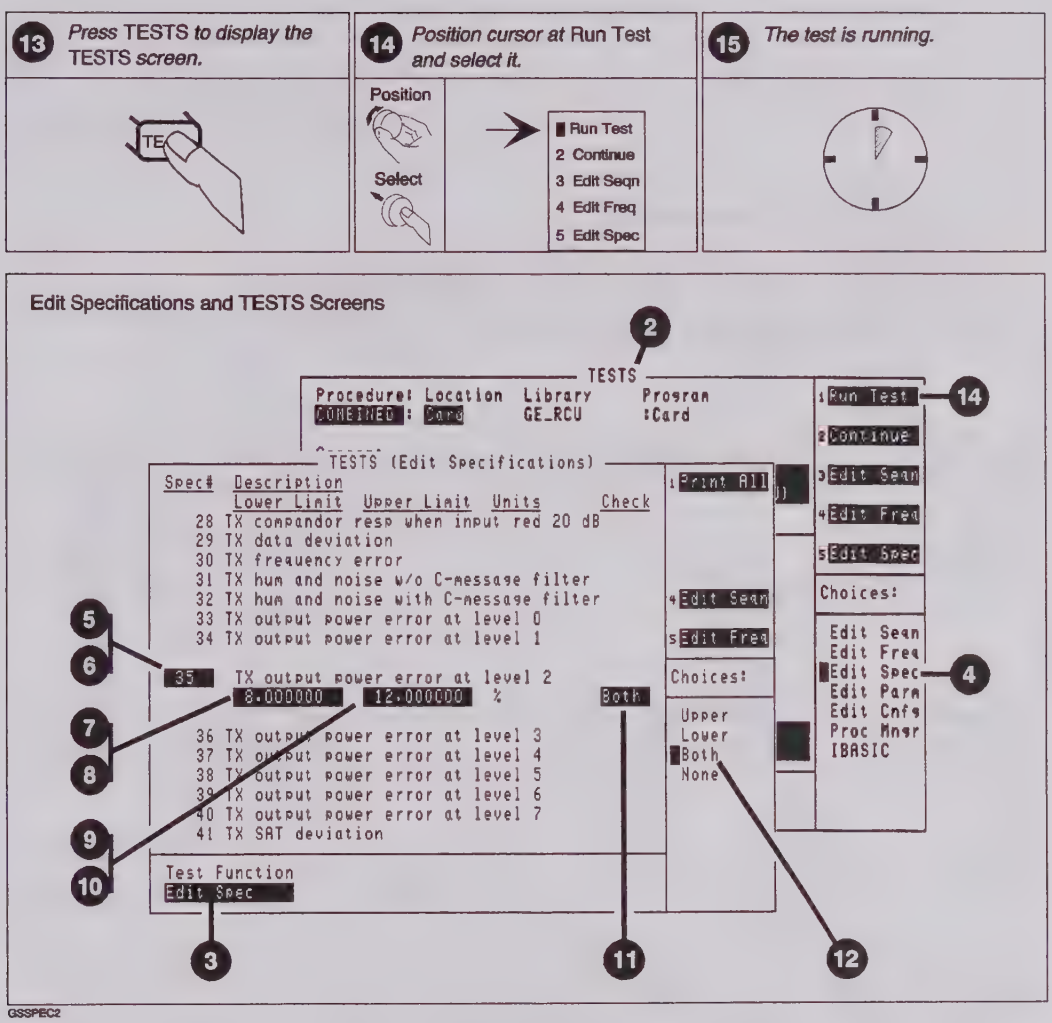
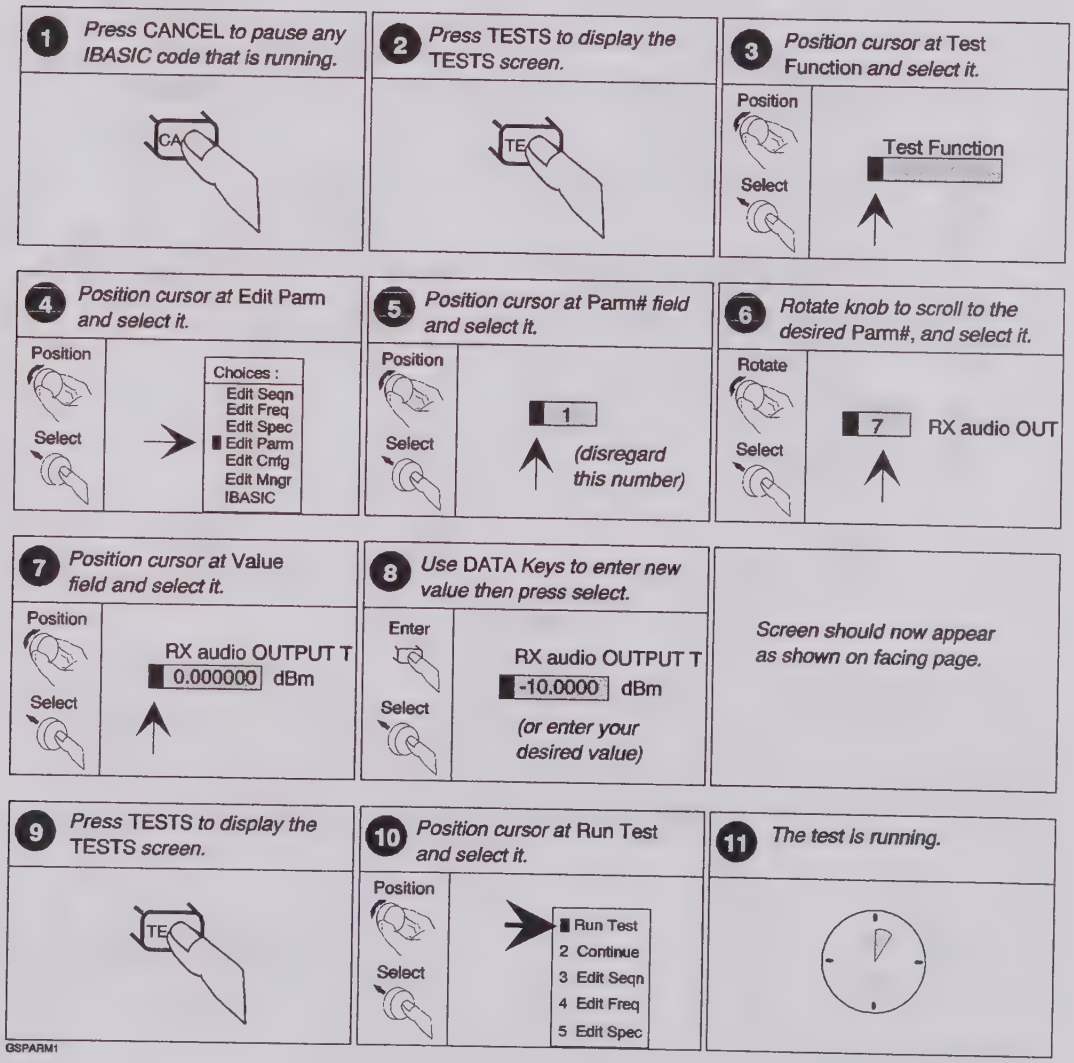


FIGURE 9

Occasionally the specification values may change or be different from cell site to cell site; this may not only produce a false failure and false adjustment, it can also prevent adjustment since the HP 8921A on-screen meters may be off-scale. For example, if the TX power level for PL3 is 10 Watts at a particular cell site and the test procedure isn't modified, the on-screen scale displayed will be 3.5 to 5.5 Watts or out of range for the required 10 Watts. This example assumes the new specification values are 8 Watts for the LOW LIMIT and 12 Watts for the HIGH LIMIT. THIS SPECIFICATION CHANGE WILL REMAIN UNTIL YOU SELECT A NEW PROCEDURE. For more details on specifications, see chapter 3 of the HP 11807B Option 041 Software Reference Guide.

K. PARAMETER VALUE CHANGE EXAMPLE: Changing RX Audio Output Test Level (Parm #7)



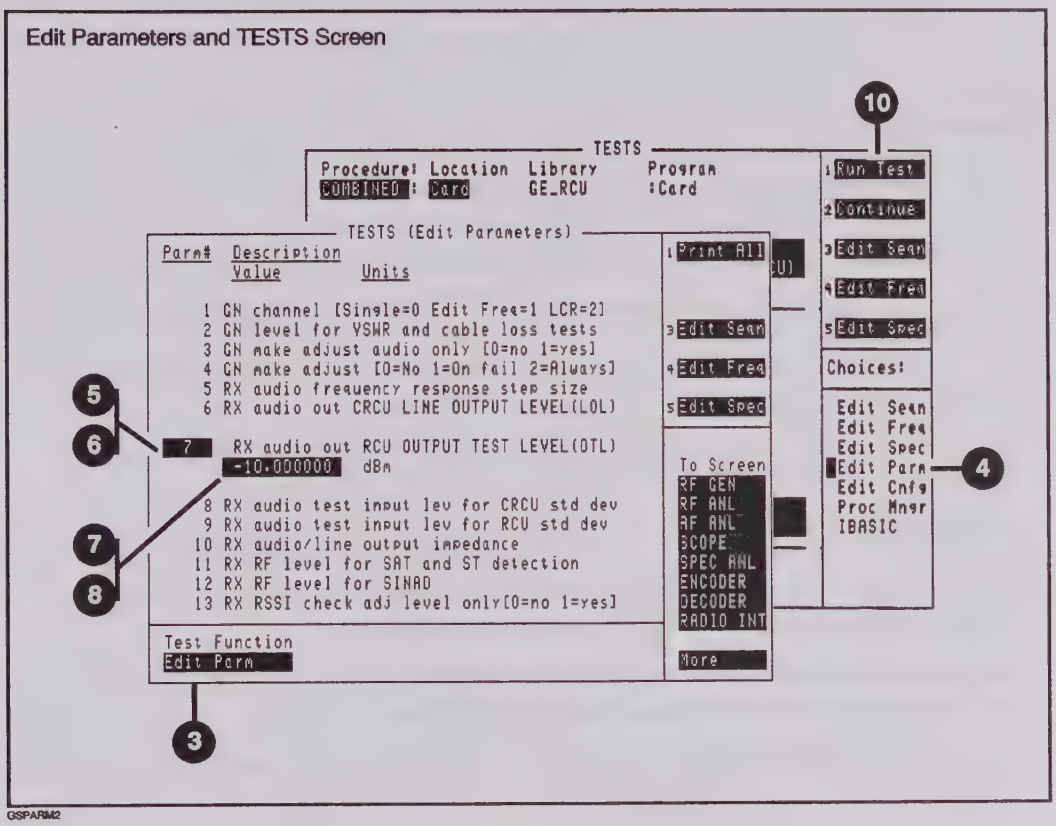


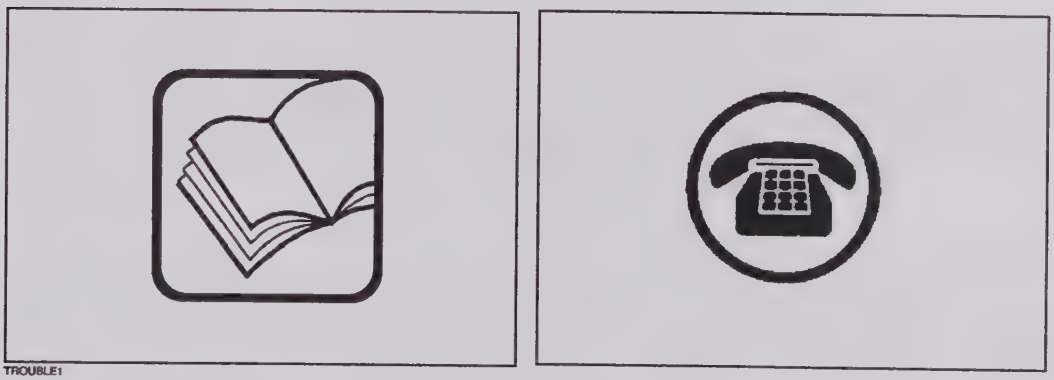
FIGURE 10

Parameter values set the state of the HP 8921A and the GE RCU during each test, e.g. the RX audio OUTPUT TEST LEVEL sets the audio level from the HP 8921A in Test #11 "TX voic dev & limiting by audio loopback". Occasionally this value may change from site to site. This example shows how to change the PARaMeter value RX audio out RCU OUTPUT TEST LEVEL (PARM #7) from 0 dBm to −10 dBm. For more details on PARaMeters, see chapter 3 of the HP 11807B Option 041 Software Reference Guide. TO STOP AND MAKE EVERY ADJUSTMENT, SET PARM #4 VALUE 2.

L. IF YOU HAVE A PROBLEM

If you cannot find what you are looking for on the screen

- Verify that the correct HP 8921A screen is displayed in each task.
- Corresponding correct reference screens are illustrated on facing pages after completing steps shown in tasks A, B, and C, etc.
- Tasks D, E, and F illustrate a portion of the correct HP 8921A reference screen that should be displayed after completing each activity.
- All reference screens also indicate the position of required fields.
- **If you do not see the illustrated screen displayed,** return to step #4, "PRESET" as shown in task A, and repeat all steps.
- Occasionally, displaying a final screen requires a 7 to 10 second wait for screen to stabilize following a "select" function.
- Verify that the HP 11807B Option 041 memory card is inserted firmly and in the proper orientation: task A.



TROUBLE1

IF YOU NEED ADDITIONAL HELP ... Consult the HP 11807B Option 041

Reference Guide or call the HP 8921A Hotline 1-800-922-8920 and give your software model number.

M. TROUBLE CHECK

Task	Symptom	Cause	Corrective Action	Ref
A	Power doesn't turn ON	Line cord not attached	Attach line cord	*
		HP 8921A warm-up delay	Wait 20 seconds	A
		AC/DC switch in wrong setting	Set AC/DC to AC	*
A-F	Wrong screen display	HP 8921A warm-up delay	Wait 20secs; press PRESET	A
		Pressed knob while rotating	Repeat start-up sequence	A
		Rotated knob while pressing	Repeat start-up sequence	A
B-C	No Procedures, Error 80	Improperly inserted CARD	Orient & insert firmly	A
		Improper CARD	Verify 11807B Opt 041	2
D	No sign on message found	No power to GE_RCU	Apply power to GE_RCU	
		Improperly cabled RS-232	Properly cable 6 pin RJ-11	Fig 4
		RJ-11 needs to be 6 pins	Properly wire DB-25 connector	1-7**
A	Wrong screen on restart	Shows last screen until HP 8921A finishes thinking	Wait 20 seconds	*
		IBASIC is still running	Press CANCEL to pause IBASIC prior to TESTS or PRESET keys	*
E	Tests stopped, won't continue	Stopped on UUT failure	See task G	G
E	Measurement failed spec	Incorrect spec value	Edit spec values	J
		Incorrect parameter value	Edit parameter values	K
		Faulty cabling	Repeat cabling instructions	Fig 4
		Faulty base station	Repair/adjust base station	
A-E	No BEEPS	BEEPS Turned OFF	Go to SHIFT CONFIG screen, select Beeper Loud or Quiet	2-22*

* HP 8921A Reference Manual P/N 08921-90022

** HP 11807B Opt 041 Software User's Guide P/N 11807-90014

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1a

Product Description

HP 11807B Software

The HP 11807B Software performs fast, accurate, automated tests that determine RF and audio performance of Cellular Base Stations.

HP 11807B Option 041 software can be used for the installation, maintenance, and/or repair of:

- GE Radio Channel Unit (RCU) Extended and Non Extended Frequency
- GE Compact Radio Channel Unit (CRCU)

Items Supplied in the Software Package

The HP 11807B Option 041 Software Package contains:

- HP 11807B Option 041 GE Software card
  part number HP 11807-10013
- HP 11807B Option 041 GE Cell Site Test Software User's Guide
  part number HP 11807-90014
- Software licensing agreement
- 128 Kbyte SRAM memory card for storing customized test programs and results. This card must be initialized, see *Memory Cards* in chapter 5 for the initialization procedure.
  part number HP 85702A

Equipment Needed

- HP 8921A Cell Site Test Set.
- HP 8921A firmware revision A.06.07 or above
- Accessories:
  - HP 83202A Option 044 Northern Telecom/GE Base Station Accessory Kit (see description in Chapter 2)
    part number HP 83202A Opt 044
  - or, other switch and interconnect arrangements
- *Optional:*
  - Printer and printer connection cable for documenting test results.
  - PC, disk drive, or HP Palmtop and appropriate connection cable for storing test results.
  - Radio Interface Card (Option 020).

GE Software Functions:

Using the HP 11807B Option 041 GE Software you can test:

- TX RF Power Level
- TX Frequency Error
- TX SAT Frequency Error and Deviation
- TX Data Deviation
- TX Voice Deviation
- TX Audio Frequency Response
- TX Audio Distortion
- TX Hum and Noise
- TX Compandor Response
- RX Audio Line/Output Level
- RX1 and RX2 Audio Level
- RX Audio Loopback
- RX1 and RX2 Sensitivity
- RX1 and RX2 Signal Strength Indicator
- RX1 and RX2 SAT Detection
- RX1 and RX2 ST Detection
- RX1 and RX2 SAT and ST Falsing
- RX1 and RX2 Audio Frequency Response
- RX1 and RX2 Audio Distortion
- RX1 and RX2 Hum and Noise
- RX Expander
- RX SAT and ST alignment
- TX Operation Tests
- RX Operation Tests
- RT Combined Operation and Alignment Test
- RT System Alignment
- RT Complete Alignment
- RT Full Parametric Tests
- Swept Return Loss
- Discrete Return Loss
- Cable Fault
- Cable Loss

For a full list of Tests and descriptions, see Chapter 4 *Test Descriptions*.

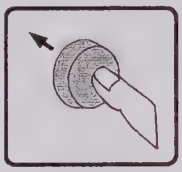
Software Features

The following features simplify testing:

- Base station control commands are automatically sent from the Test Set via the RS-232 interface. Responses from the base station are received and used by the software.
- System interconnects are graphically shown on the Test Set CRT display.
- Results of tests and pass/fail indications are displayed on the Test Set CRT, and can be printed, or collected in an HP Palmtop, PC or terminal, disk drive or memory card.
- The software allows the operator to change the TEST sequence, channels, specifications, parameters and equipment configurations.
- RF path losses can be determined and corrected.
- User has the option to repeat a test on failure (as many times as desired), or continue testing.
- User may exit to laptop from the test environment.
- Tests can be run to measure cable fault, cable loss, and VSWR.

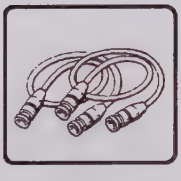
Finding the Information You Need

This manual describes the setup and use of the HP 11807B Software with the HP 8921A Test Set. The book is arranged in self contained chapters to meet the following objectives:



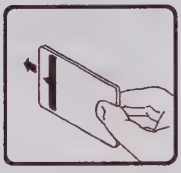
GETTING STARTED-CHAPTER 1

- Fast paced, hands on tutorial.
- Basic test set/software operation.
- First time or occasional users.



CONNECTIONS-CHAPTER 2

- Instructions for cabling test set.



USING THE SOFTWARE-CHAPTER 3

- How to load
- How to run
- How to customize
- Conceptual overview

TEST DESCRIPTIONS-CHAPTER 4

Definitions, special conditions and restrictions for:

- Tests
- Specifications-Pass/fail limits
- Parameters-Test conditions

REFERENCE-CHAPTER 5

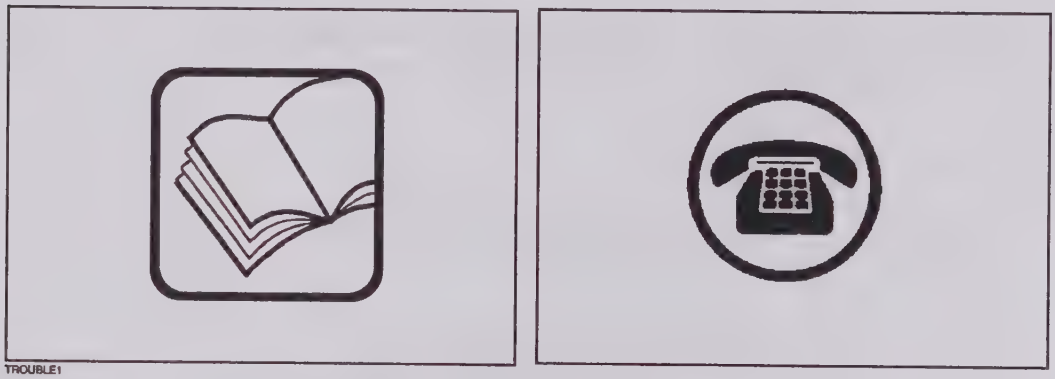
- Alphabetically listed
- Detailed descriptions of all the features and functions of the HP 11807B software.
- For the advanced level user.

PROBLEM SOLVING-CHAPTER 6

- Alphabetically listed
- Symptoms and possible corrections to frequent user problems.

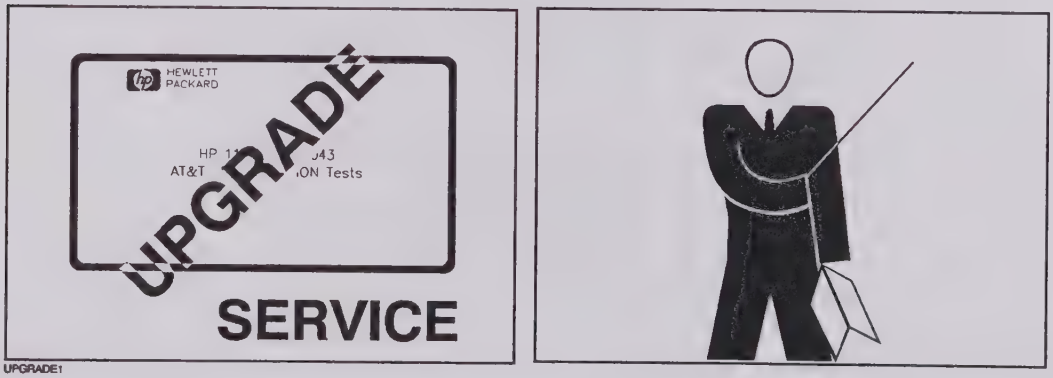
MANUAL1

Additional Services Available



TROUBLE1

Consult the HP 8921A Reference Guide or call the HP 8921A Hotline 1-800-922-8920 (USA and Canada only) or 1-509-994-9385 and give your software model number if you encounter a problem.



UPGRADE1

Contact your local HP Sales Representative for information about the Software Upgrade Service and the Start Up Assistance Training Course.

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2

Making Connections

This chapter describes how to:

- make connections to the RCU and CRCU transceivers.
- determine calibration parameters.

Equipment Needed

The following equipment is needed for testing:

- GE transceiver to test
- HP 8921A Cell Site Test Set
- Cables and Connectors (described below)

Cables and Adapters Included in Accessory Kit

The following cables and adapters may be purchased together in the Northern Telecom/GE Accessory Kit (part number HP 83202 Opt 044) or separately through your own vendor(s).

Caution **Damage to Equipment**

The Test Set and other equipment in this test system can be damaged by transient RF power, continuous RF power, high voltage, electrostatic discharge from cables and other sources, and transients caused by lightning. Connections to equipment, switch settings, and power-on conditions must be chosen to reduce the risk of damage to the equipment.

Cables/Adapters Contained in Accessory Kit

Description	Purpose	Quantity	Part Number
BNC to Single Banana Adapter	Connects AUDIO IN HI/LO to Dual banana adapter	2	1250-2164
Dual Banana to BNC Adapter	Connects Test Set AUDIO IN HI/LO to balanced line input	1	1251-2277
Type N(m) to N(m) Cable, 10 ft	RF IN to TX output connector	1	08921-61010
BNC(m) to BNC(m) Cable, 10 ft	Duplex out to RX input cable	1	08921-61011
RJ-11(m) to RJ-11(m) 6-wire cable, 25 ft	Connects to dual port splitter or Test Set rear-panel serial port and to RJ-11 to DB-25 adapter	1	08921-61015
RJ-11(f) to DB-25(m) Adapter	Provides control capability for GE RCU and provides connection for NT radios	1	08921-61018
BNC to Bantam 309 cable, 10 ft	Audio connections (reverse & forward audio) for radios	2	08921-61024
RJ-11(m) to RJ-11(f) Dual-Port, 6-wire splitter	Provides interface to both rear-panel serial ports on Test Set	1	08921-61031
DB-25 to Bantam 309 cable	Provides control capability for NT P-Series radios	1	08921-61034
DB-9 to RJ-11 Cable	Interface to PC for data collection	1	08921-61038
DB-25 to RJ-11 Cable	Interface to printer for data collection	1	08921-61039

Cables/Adapters Contained in Accessory Kit (continued)

Description	Purpose	Quantity	Part Number
DB-25 to RJ-45 adaptor	Provides control capability for Northern Telecom DRU radios	1	08921-61027
RJ-45 to RJ-45 8-wire cable	Provides control capability for Northern Telecom DRU radios	1	8120-6343
DB-9(m) to RJ-11(f) Adapter	Provides control for GE CRCU	1	0892-61045
BNC(m) to Molex 20 ft cable	To RCU rear-panel TEST 1 and Test Set AUDIO OUT	1	08921-61012
BNC to 4 pin LF (f) (Low Frequency) 20 ft cable	Test Set audio out connection to CRCU test bus input	1	0892-61045

HP 8921A

Additional Cables and Connectors Needed

The following cables are needed for VSWR, Cable Fault, and Cable Loss Tests. These parts are NOT included in the accessory kit.

Additional Cables/Adapters Needed

Description	Purpose	Quantity	Part Number
SWR bridge Type N(m)	For all VSWR measurements	1	Eagle[1] RLB150N3B or equivalent
BNC(m) to BNC(m) cable, 1 ft	SWR bridge source input/reflected out to Test Set DUPLEX OUT and ANT IN	2	HP 08120-1838
N(m) to BNC(f) adapter	Adapter for Test Set RF IN/OUT connector for the SWR bridge and power divider	2	HP 1250-0780
6 dB Pad, BNC(f) to BNC(m)	SWR bridge and cable loss matching to Test Set matching	2	HP 0955-0698
50 Ω termination connector type as required	Termination for cable-under-test	1	None
Resistive power splitter, 2 GHz BNC(f), 3 dB	For cable fault locations	1	0955-0733

1 Eagle, P.O. Box 9446, Wichita, KS 67277, (316-942-5100)

Equipment Connections

Many arrangements of test equipment and base station equipment are possible. In this manual, some of these possibilities are presented. Radio Interface control of the RF and audio switches is described in this section. Refer to this section and Appendix A if you are using an HP 3488A Switch/Control Unit.

Figure 2-1 is an overall system block diagram.

After you have set up your system, you will be calibrating some system components. Tests should be run with the equipment connected the same way it was calibrated.

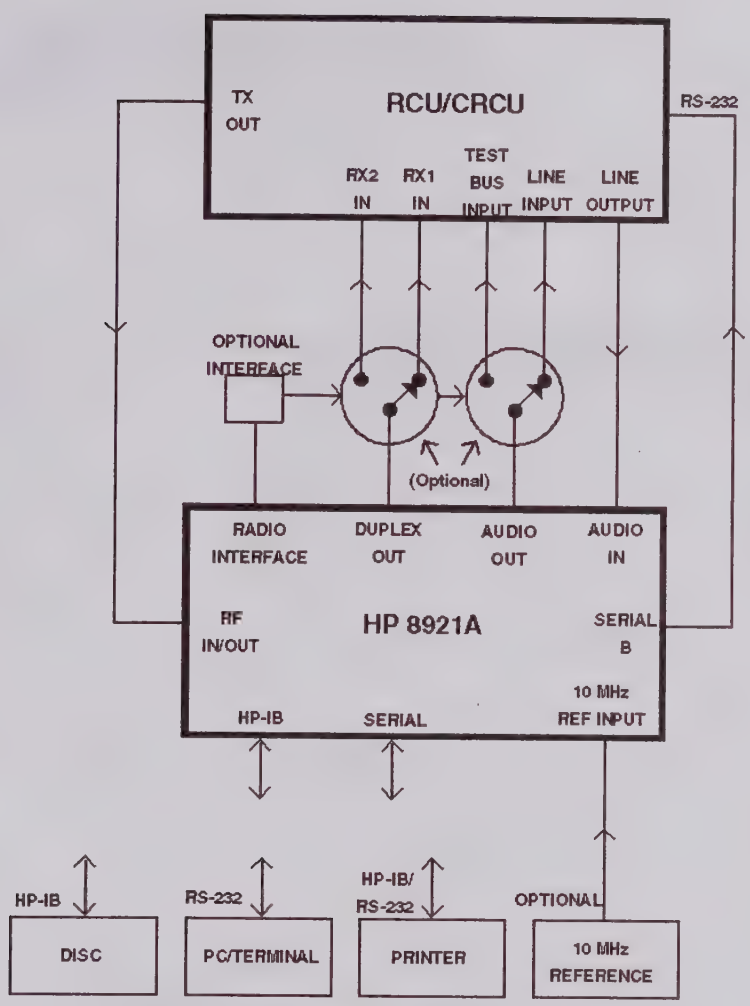


Figure 2-1. Overall System Block Diagram

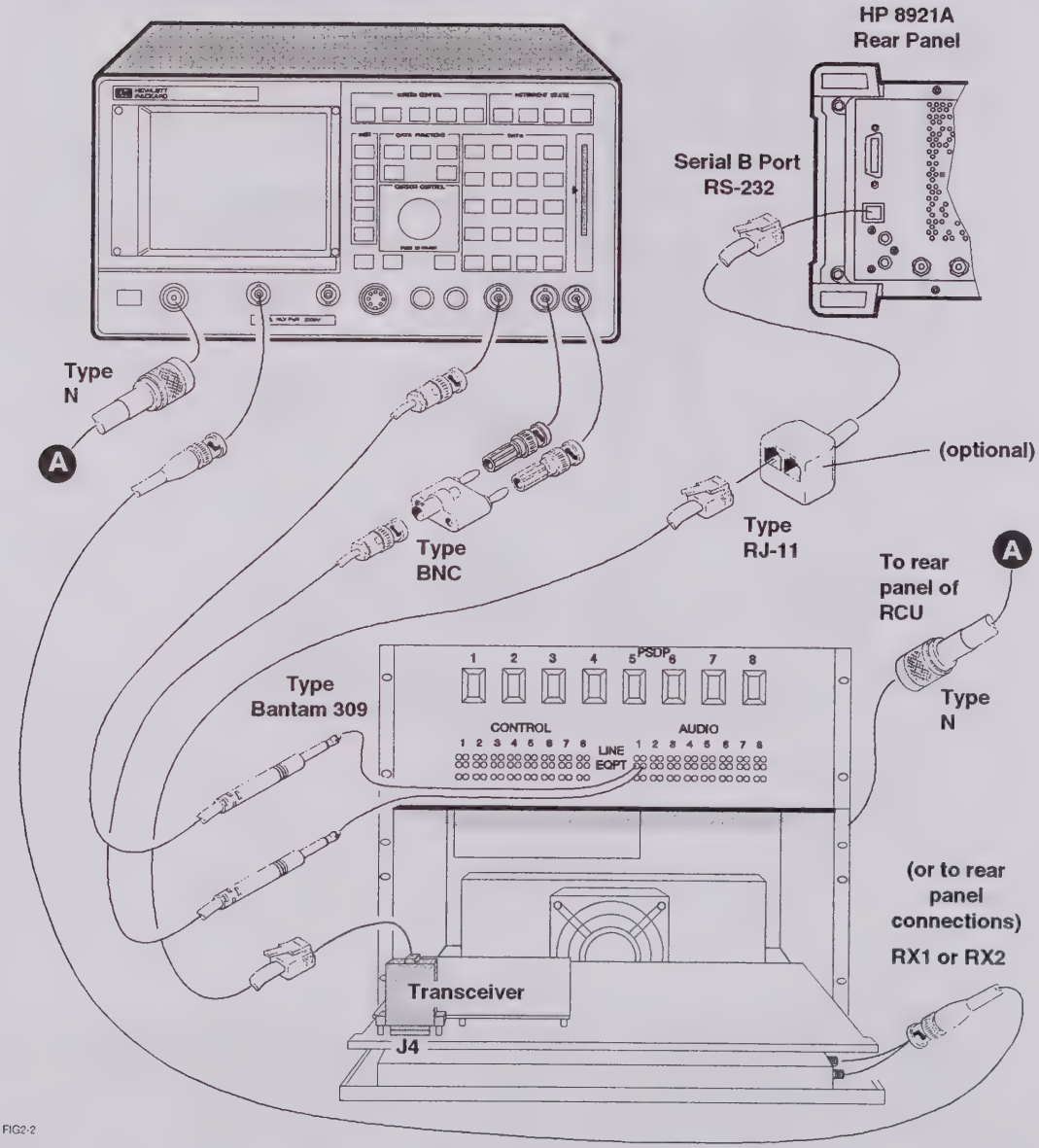


Figure 2-2. Test Set - RCU Connections

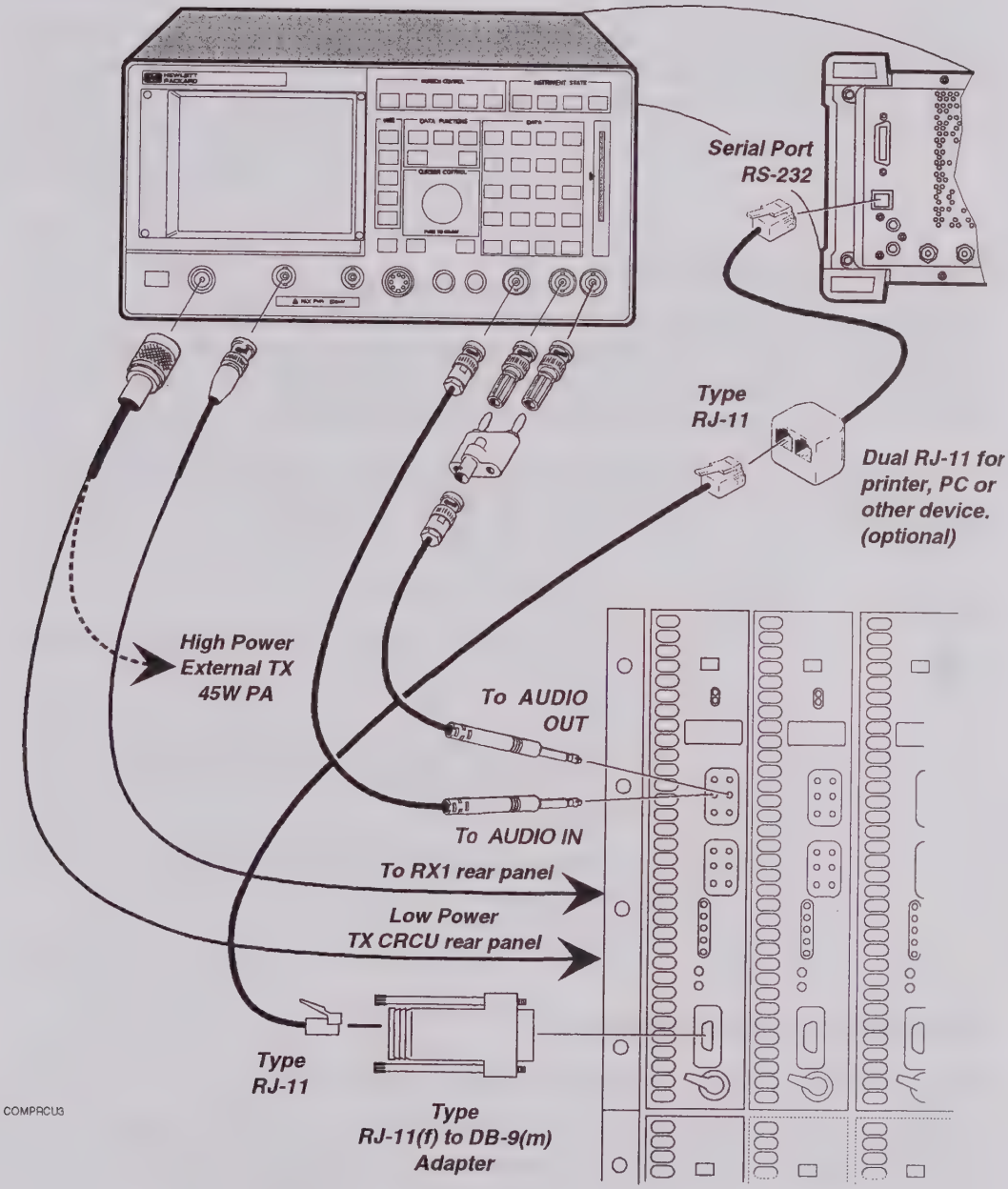


Figure 2-3. Test Set - CRCU Connections

Receiver RF Connections

See figure 2-2 or 2-3 for the details of these connections. If you are not automatically selecting the RX1 and RX2 inputs, an RF cable is used to connect the RX1 or RX2 connector to the Test Set's DUPLEX OUT connector; the software will prompt you when the connection needs to be changed.

If you are using an RF switch, the common port of the switch is connected to the Test Set's DUPLEX OUT connector. See *Radio Interface Connections* for details of the connection of the Radio Interface to the switch.

Caution **Damage to the DUPLEX OUT Port**

The application of RF power greater than 200 mW (+23 dBm) can damage the Test Set's DUPLEX OUT port. Be certain that signals applied to this port are less than 200 mW. If an RF power higher than about 200 mW is applied, an overpower relay will trip. Press (MEAS RESET) or turn the Test Set's power off and on to reset it.

To minimize the risk of high power being applied to the DUPLEX OUT connector, do not use a Type N to BNC adapter on the RF IN/OUT connector.

Transmitter RF Connections

See figure 2-2 or 2-3 for a description of these connections.

The transmitter's high-power output is connected to the Test Set's RF IN/OUT connector with a low-loss cable with Type-N connectors.

Audio Connections

See figure 2-2 or 2-3 for a description of these connections. The figure does not show connections to the TEST jack. If you are not automatically switching the audio lines, the software will prompt you to disconnect the Test Set's AUDIO OUT to line/audio input connection and connect the Test Set's AUDIO OUT to the TEST input.

RCU Connections

You will normally be making audio connections to the EQPT Bantam 309 jacks on the Power and Distribution Panel (PSDP) that interface with the RCU you are testing. The test bus inputs are generally made on the rear of the RCU. However, the entire test tone bus (daisy chain) can be connected to the PSDP by connecting the spare audio cable to the first RCU after the Test and Alarm Unit (TAU). Remove the daisy chain coming from the TAU first. Then connect a spare audio cable between the first RCU and a free position on the PSDP (e.g., position 8). This will save time when an alignment is to be done on more than one RCU.

This procedure cannot be used if any RCU is in the alarm state as it will cause improper alignment (i.e., a new cell site installation).

CRCU Connections

The audio cables are connected to the Audio Equipment (E) jack on the CRCU's front panel. The test bus input is connected to the CRCU's shelf back plane Test Bus connector (J26). There must be no other connection to the CRCU's test bus connector on the CRCU's shelf back plane.

External Switching

Little benefit will generally be gained if you decide to automatically select the Test Set's AUDIO OUT destination with an external switch. If you wish to do automatic switching, an SPDT switch may be installed so that the test software can select either the transmitter's AUDIO input or the TEST jack to be connected to the Test Set's AUDIO OUT.

See *Radio Interface Connections* for details of the connection of the Radio Interface to the audio path switch.

Connection for RS-232 Control of the RCU and CRCU

The HP 11807B Option 041 software automatically controls the RCU through connector J4 on A5 - Logic Board. This DB-25 connector is accessed by lowering the front cover of the RCU. Other connections to the RCU are not supported.

The HP 11807B Option 041 software automatically controls the CRCU through the Terminal Connector on the front panel of the CRCU module. Other connections to the CRCU are not supported.

The Test Set has a rear-panel RJ-11 connector for serial communication. See figure 2-4. It has two serial ports on it, Serial port and Serial B port. The Serial B port is used for RCU control and messaging.

Note **Check the RJ-11 Wiring**

RJ-11 cable and adapters can be wired several ways. Verify the connections between the Test Set's RJ-11 connector and the DB-25 RCU connector or the DB-9 CRCU connector.

The connections between the Test Set's RJ-11 connector and J4 on A5 - Logic Board or DB9 are described below:

Table 2-1. Pinouts for RCU or CRCU Control

Item	Test Set	RCU	CRCU
Test Set Receive B data	RJ-11 Pin 1	J4 pin 3	DB-9 pin 3
Ground	RJ-11 Pin 4	J4 pin 7	DB-9 pin 7
Test Set Transmit B data	RJ-11 Pin 6	J4 pin 2	DB-9 pin 2

RCU Pinouts

The transmit data line (pin 6) for this serial port is the uppermost pin on the RJ-11 connector on the rear panel of the Test Set. If you use a Radio Shack adapter (part number 276-1405), you will have to insert three supplied pins into the DB-25 connector. The pins are connected with wires to the RJ-11 connector. See table 2-1 and figure 2-4 to determine which pins to insert.

Serial Port Connections for Data Collection

The HP 11807B Option 041 software has the capability to upload test results to an external computer. One way to accomplish this is by running a terminal program on a laptop or other computer and using terminal logging to save information sent out the Test Set's Serial port.

The following pins are used by the Serial port:

- RJ-11 Pin 2 - Test Set Receive data
- RJ-11 Pin 4 - Ground
- RJ-11 Pin 5 - Test Set Transmit data

See figure 2-4. The transmit data line (pin 5) for the Serial port is just below the uppermost pin on the RJ-11 connector on the rear panel of the Test Set.

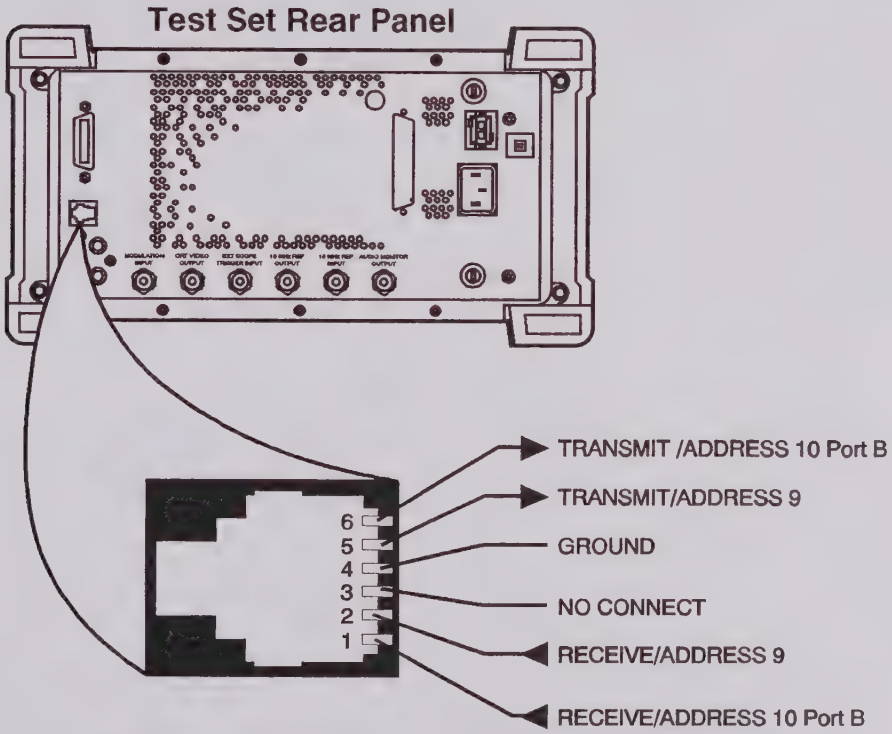


Figure 2-4. Test Set RJ-11 Serial Port Connections

Note

This DB-9 to RJ-11 cable (HP part number 8921-61038) is included in the Northern Telecom/GE Accessory kit. See *Cables/Adapters Contained in Accessory Kit* earlier in this chapter.

Printer Connection

An HP-IB printer can be connected to the Test Set's rear-panel HP-IB connector. A serial printer can be attached to the Serial port. See figure 2-4. Use the following RJ-11 pins for this connection.

- RJ-11 Pin 2 - Test Set Receive data
- RJ-11 Pin 4 - Ground
- RJ-11 Pin 5 - Test Set Transmit data

Note

This DB25 to RJ11 cable (HP part number 8921-61039) is included in the Northern Telecom/GE Accessory kit. See *Cables/Adapters Contained in Accessory Kit* earlier in this chapter.

See *Printing* in chapter 5 for information on how to set up the Test Set for printing.

Radio Interface Connections

Caution **Damage to the Radio Interface Card**

Damage to the Test Set can result if the RF or Audio switches generate transients that are conducted into the Test Set via the Radio Interface connector. It may be necessary to install diodes on the Radio Interface control lines to suppress transients caused by the switches. Refer to the switch's manual for the proper interface to TTL or CMOS control lines.

The parallel lines of the Radio Interface Card can be used to control an RF and an Audio switch. The software will use the entries made into the TESTS (`Edit Configuration`) screen to set the state of the parallel lines. The line will be set high when the position in the following table is selected. By using the `LOW` option the polarity of the lines can be inverted.

The following pins on the Radio Interface DB-37 connector are used to control switches:

Table 2-2. Pinouts for Switch Control

Pin #	Pin Description	Switch Type	Switch Setting
1	GND		
19	Parallel Data Out - D0	RF switch	RX1
20	Parallel Data Out - D1	RF switch	RX2
25	Parallel Data Out - D6	SPDT Audio switch	TEST BUS
26	Parallel Data Out - D7	SPDT Audio switch	AUDIO INPUT

The Radio Interface Card has the capability to have a 5.1 volt or user-changeable high-state logic output voltage.

The Parallel Data Out lines are open-collector outputs with 3.16 kΩ internal pull-up resistors. The resistors are connected between the collectors of the drive transistors and a logic voltage that may be determined by an externally applied voltage. The internal logic voltage is approximately 0.6 volts less than the voltage externally applied to pin 9 of the Radio Interface connector. The applied voltage can be between 5.1 volts and 20 volts. The maximum loading on the voltage is 145 Ω to ground. If no voltage is applied, an internal 5.1 volt source is used as the logic voltage.

The characteristics of the parallel lines are:

High-state output : 3.16 kΩ pull-up to the logic voltage. See the previous paragraph.

Output sink current (low-state, output voltage $\leq$ 1.5 volts) : 6 mA minimum, 16 mA typical

Series chokes : 4.6 μ H for RFI control on all lines.

Clamp diodes for ESD protection : The applied voltage must not exceed the logic voltage plus 0.6 volts, or be less than −0.6 volts.

DC Power to the RF and Audio Switches

DC power must be supplied to the RF and audio switches. It cannot be supplied from the Radio Interface Card. Refer to the switch's documentation for power requirements.

Determining Calibration Parameters

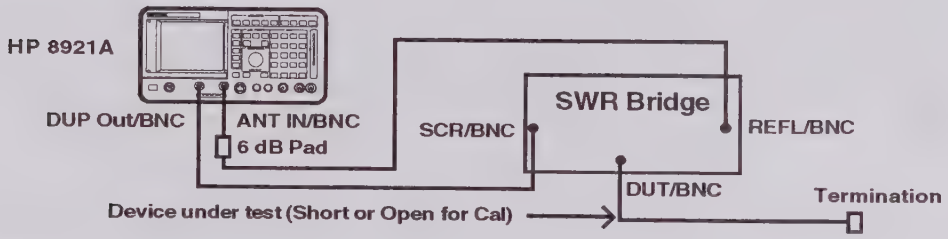
The accuracy of RF power measurements and receiver sensitivity measurements is affected by the loss of the cables and RF switches connecting the transceiver and the Test Set. Inaccuracies can occur in your measurements due to cable losses and impedance mismatches in your test system. It is important therefore that the appropriate calibration factors are entered as parameters into the TESTS (`Edit Parameters`) screen. *TEST_47 GN Measure Cable Loss* can be used to measure the calibration factors for the RX and TX path losses.

After running this test, you must enter the value into parameters *RX1(2) path loss* and *TX path loss (dB)*.

Note

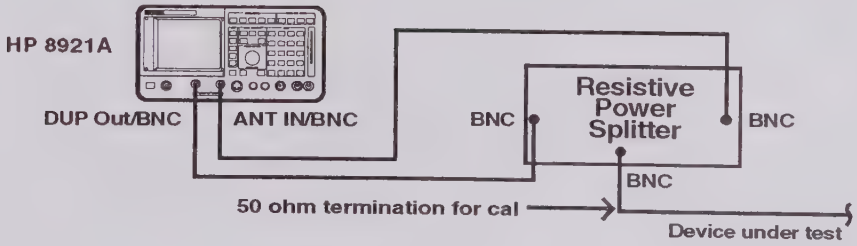
If you are not using an RF switch, enter the same value for both RX parameters. If you are using an RF switch, create a procedure which will run TEST_43 to control the switch followed by TEST_47 to measure cable loss. Repeat this sequence of two tests for as many switch positions as you have (see chapter 3). You will still need to note the measured values for each cable and enter them into parameters *RX1(2) path loss*.

TEST_44 GN Swept Return Loss (VSWR) and TEST_45 GN Discrete Return Loss (VSWR)



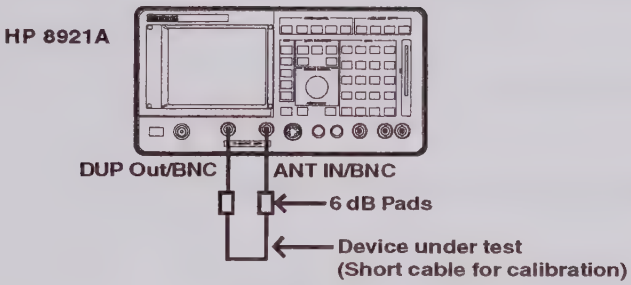
vswra.tif

TEST_46 GN Cable Fault



vswrb.tif

TEST_47 GN Measure Cable Loss



vswrc.tif

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3

Using the Software

The HP 11807B Software can be run on the factory default settings or customized to your individual needs and specific requirements.

This chapter provides detailed information on how to load, run, and customize the software.

Testing Overview

Pressing [TESTS] will display what is called the TESTS screen. From this TESTS screen you have the option to:

Begin running tests:

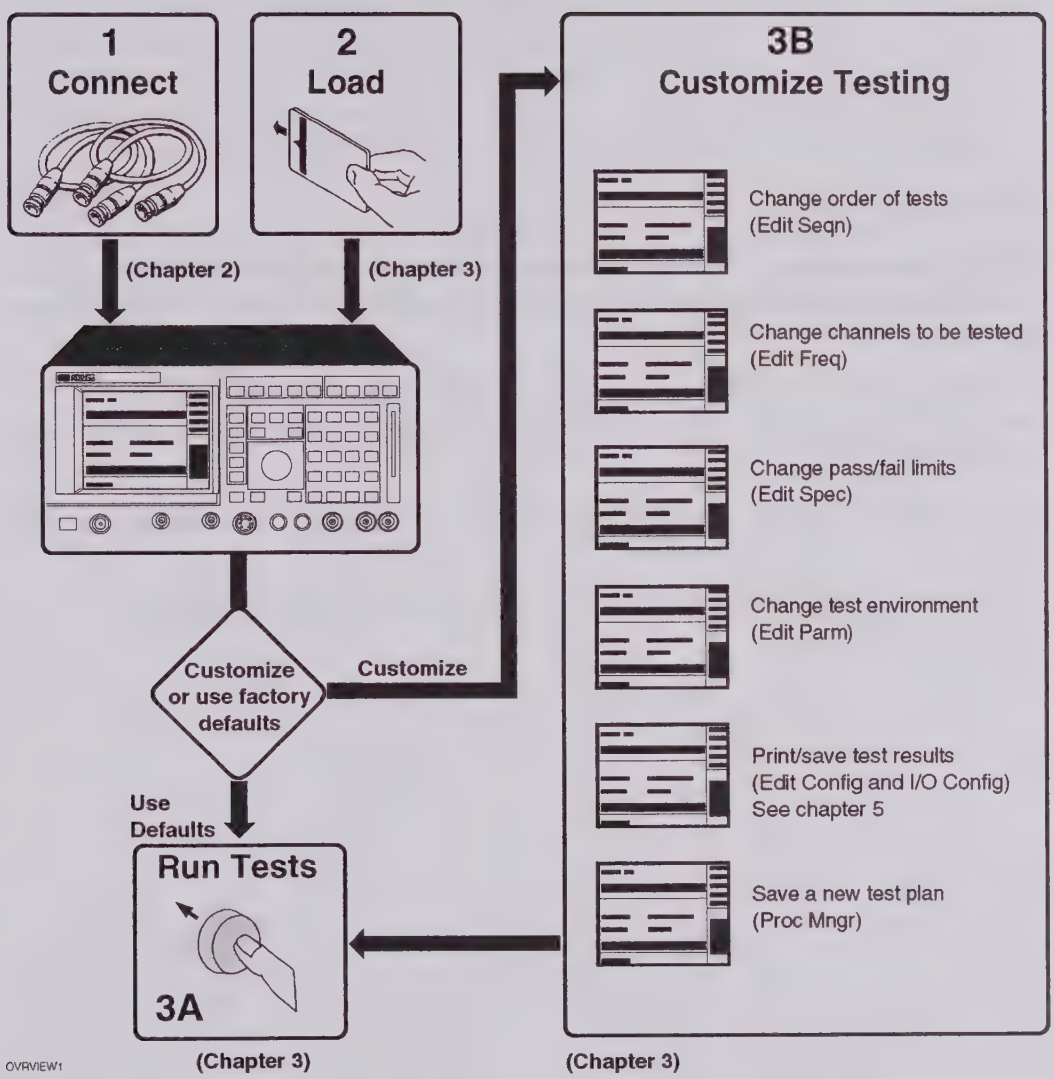
- The factory default settings are acceptable for your application or
- The software has already been customized for your cell site, and saved to an SRAM card

or

Customize the software:

- Decide which tests you desire to run (Edit Sequence)
  - you may want to run all, some, or just one of the tests.
- Specify which channels to test, and enter frequency information (Edit Frequency)
  - you may want to test one, some, or all of the radios on the shelf.
- Change the pass/fail limits for specific measurements (Edit Specifications)
  - you may want the pass/fail limits to have tighter or looser specifications than the default settings.
- Change the test environment and conditions (Edit Parameters)
  - define if certain values should be measured or calculated.
  - decide output format.
  - enter specific information about cell site equipment and/or environment.
- Save any or all of the above customized changes (to an SRAM card)
- Select options:
  - Print test results or certain screens.
  - Decide when and where test results are displayed (`Test Execution Conditions`)

To Run Tests


1
Connect
2
Load
3B
Customize Testing
(Chapter 2)
(Chapter 3)
Change order of tests
(Edit Seqn)
Change channels to be tested
(Edit Freq)
Change pass/fail limits
(Edit Spec)
Change test environment
(Edit Parm)
Print/save test results
(Edit Config and I/O Config)
See chapter 5
Save a new test plan
(Proc Mngr)
Customize
or use factory
defaults
Customize
Use
Defaults
Run Tests
3A
OVRVIEW1
(Chapter 3)
(Chapter 3)

Running Tests

Before you begin to load the software and run tests, you should have made the appropriate hardware connections. See *Connections* in chapter 2 if you have not done so already.

The HP 11807B Software may be run with its factory default settings, or it may be customized to your specific needs (see *Customizing Testing* later in this chapter).

When TESTs begin to run, they are executed in the order in which they were entered into the Test Procedure.

- Pressing [CANCEL] will pause the current test (press [K2] `Continue` to continue the test).

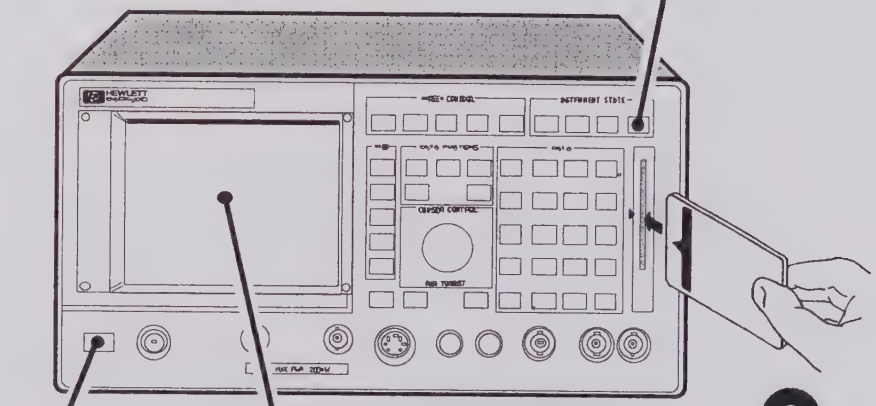
Loading the Software

Before you begin testing, you must load the software into the test set memory. To load the software, you must first select the location to load from (in this case, it will be `Card`) and a procedure filename. Your card comes pre-programmed with at least one procedure. The actual software program does not get loaded into the test set memory until (K1) `Run Test` is selected. It will take approximately two minutes for the software program to be loaded at that time.

The software memory card can be removed after the program is loaded into the HP 8921A memory. The program will remain in memory after a power-down/power-up cycle, unless it is manually deleted or a new program is loaded.

Do steps 1-4 in numbered order.

(PRESET is a reset command that can be used at any time to restart.)



4 *Press* **PRESET**

1 *Press* **POWER**

2 *Wait about 20 sec. for a display to appear, then go to step 3.*

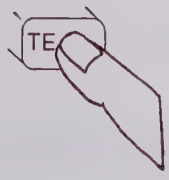
3 *Insert card* **HP 11807B**

LOAD1

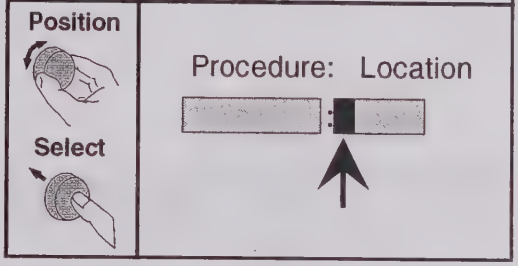
Continue on next page

5 *Press* **TESTS** *to display the* **TESTS** *screen.*

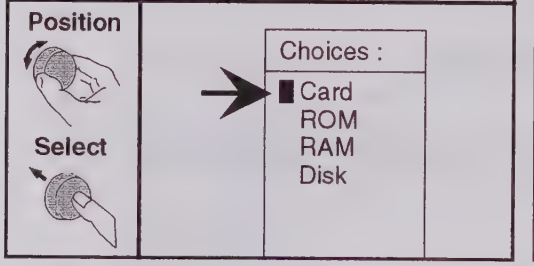
If you are in **IBASIC**, *press* **SHIFT, CANCEL** *before pressing* **TESTS**.



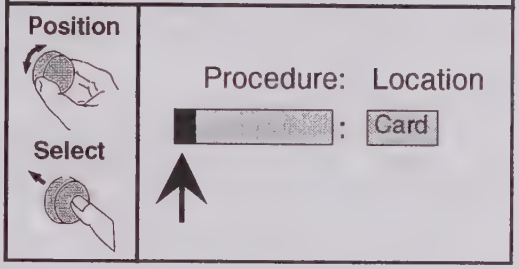
6 *Position cursor at* **Location** *and select it.*



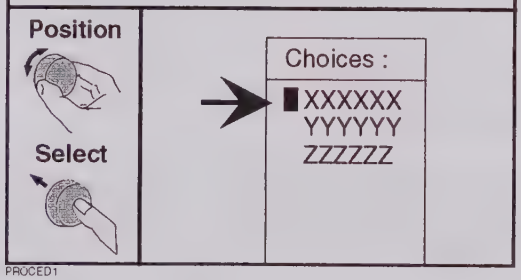
7 *Position cursor at* **Card** *and select it.*



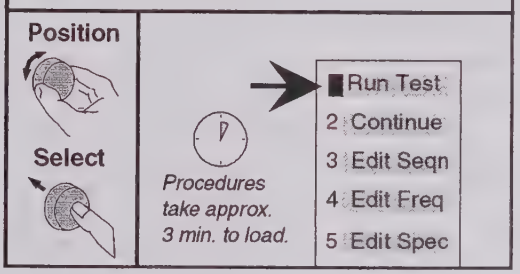
8 *Position cursor at* **Procedure** *and select it.*



9 *Position cursor at the desired* **Procedure** *and select it.*



10 *Position cursor at* **RUN TEST** *and select it.*



PROCED1

Customizing Testing

The HP 11807B Software may need some customizing before it performs in a way that is necessary for your testing needs. Because of the diversity of individual testing needs, the HP 11807B Software has been designed so that changes may be easily made from the HP 8921A front panel. You may store these changes on an SRAM card so that you may skip these steps in the future. See *Saving a Test Plan* later in this chapter.

You may customize your software at any time. Because your needs change, the software allows changes to its default settings when you need to make them and in any order that you choose. For example, tests may be inserted or deleted, and later after running the tests you can change the pass/fail limits or decide to test different channels.

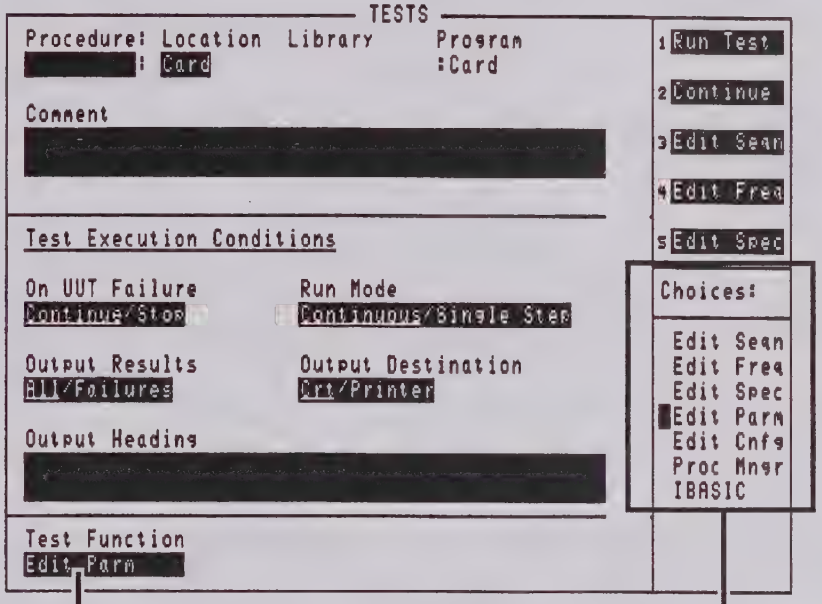
Most testing customization is accomplished through the HP 8921As' Test Function screens. These Test Function screens are accessed from the main TESTS screen as shown in the following figure. All Test Functions are explained in this chapter by function.

Note

Edit Configuration (Edit Cnfg) and IBASIC will not be explained in this customizing section.

- Edit Configuration is used when setting up switches, printers, and external disk drives which is explained in *Configuration*, *Printing*, and *Disks* in chapter 5.
- IBASIC is used when writing your own programs and is not explained in this manual. If you need to write your own IBASIC programs you may acquire the *IBASIC Programming Manual* HP part number 08920-90034. The HP 8921A manual also contains information in chapters 5 and 6 about IBASIC operation.

TESTS Screen



Selecting **Test Function** *opens the* **Test Function Choices** *menu.*

Test Function *choices.*

CUSTOM1

Changing a Sequence of Tests (Edit Sequence)

You may define a test sequence to include all, some, or just one of the tests available. When the first test is finished, the next will run. The test sequence will remain in the Test Set's battery backed-up memory until another test sequence is loaded or set up. For information on saving a customized test sequence, see *Saving a Test Plan* later in this chapter.

Creation of a test sequence is accomplished by inserting or deleting tests from the list of tests that come with the HP 11807B Software package. See *Test Descriptions*, chapter 4, for a tests list and descriptions.

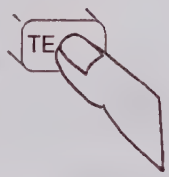
The `All Chans?` field allows the user to enter a command (yes or no) to instruct the software whether or not to run the test. This is a shortcut to turning on and off tests in a sequence without creating a new procedure.

The following describes how to create a new test sequence and enter a response to the `All Chans?` field.

How to Change a Sequence of Tests

1 *Press* **TESTS** *to display the* **TESTS** *screen.*

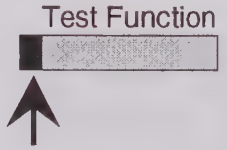
If you are in **IBASIC**, *press* **SHIFT, CANCEL** *before pressing* **TESTS**.



2 *Position cursor at* **Test Function** *and select it.*

Position

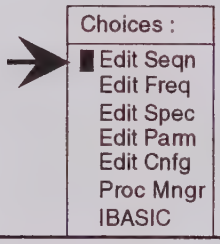
Select



3 *Position cursor at* **Edit Seqn** *and select it.*

Position

Select

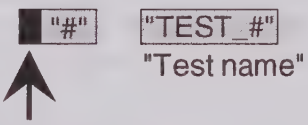


4 *Position cursor at* **Step #** *field and select it.*

Position

Select

Example

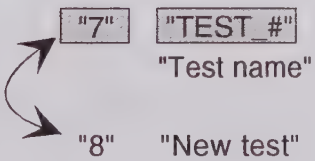


5 *By rotating knob, highlight the* **Step #** *which precedes the insertion point of the new test that you are adding, then select it.*

Position

Select

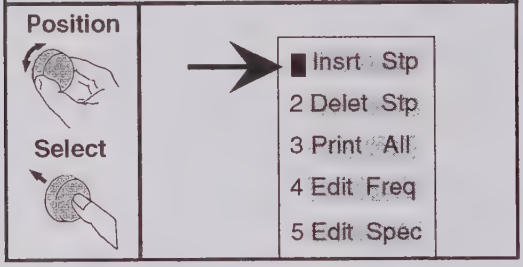
For example, select step 7 if you want to insert the new test as step 8.



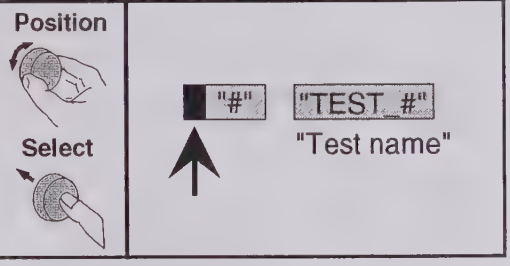
SEQ1

Continue on next page

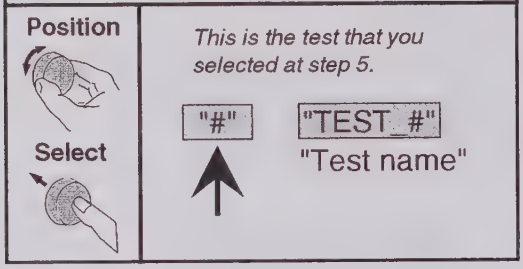
6 *Position cursor at* **Insrt Stp** *and select it.*



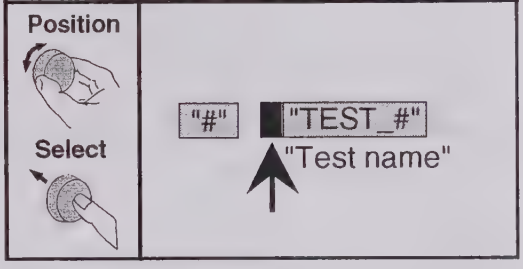
7 *Position cursor back at* **Step #** *field and select it.*



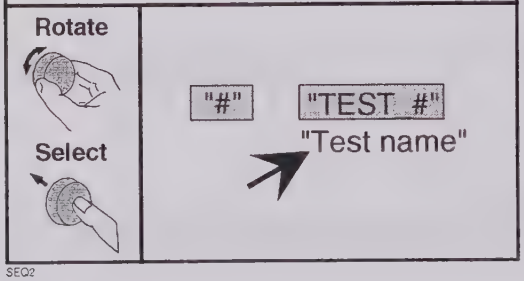
8 *Highlight* **Step #** *of the newly inserted test, then select it.*



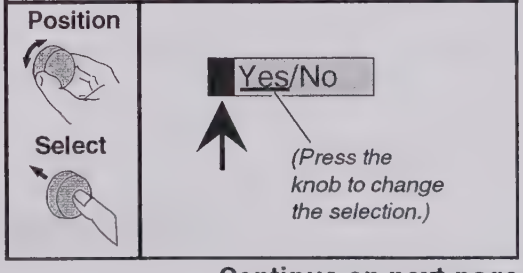
9 *Position cursor at* **Test name** *field and select it.*



10 *Rotate knob until desired* **Test Name** *appears, then select it*



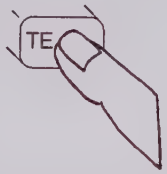
11 *Position cursor at* **All Chans?** *field and select* **Yes** *or* **No**.



SEQ2

Continue on next page

12 *Press* **TESTS** *to return to the* **TESTS** *screen*



SEQ3

Specifying Channel Information (Edit Frequency)

There are three methods of getting channel information for testing.

Parameter *GN Channel [0=Single 1=Edit Freq 2=LCR]* selects which method of channel definition is used.

Selecting 0=`Single` allows the user to input a channel number in the `Channel number` field that appears at the start of testing on the `RCU/CRCU Configuration, Setup and Testing` Screen. All tests in the test sequence will be run on this channel and then the test will stop. Next time the test is run, the channel in the `Channel number` field will need to be changed manually for the next base station you want to test. This method is useful if you just want to enter the channel number for each base station at the time you test it.

Selecting 1=`Edit Freq` inputs the first channel number contained in the `Edit Frequency` Screen into the `Channel number` field on the `RCU/CRCU Configuration, Setup, and Testing` Screen. All tests in the test sequence will be run on this channel and then the software will return to the `RCU/CRCU Configuration ...` Screen. The `Channel number` field will now contain the next channel specified in the `Edit Frequency` Screen. The software will perform all the tests in the sequence and again return to the `RCU/CRCU Configuration ...` Screen. This will continue until the sequence of tests are run on all the channels specified in the `Edit Frequency` Screen. This method is useful if you have the entire frequency plan for the cell site saved on the memory card and you want to test all the base stations in the site.

Selecting 2=LCR is used for Locating Receiver (LCR) testing. The first channel number contained in the Edit Frequency Screen is placed into the Channel number field on the RCU/CRCU Configuration, Setup, and Testing Screen. The test sequence is run on this channel number and continues to be repeated on each channel specified in the Edit Frequency Screen. The RCU/CRCU Configuration, Setup, and Testing Screen does not appear at the start of each new channel. For example, with this method you could test RSSI on your LCR across several channels without being prompted with each new frequency.

To Use the Edit Frequency Screen

For each channel that you wish to specify to be used in the tests that you run, you must enter the following information into the `Edit Frequency` screen:

- `RX Chan Info`
  - Enter the channels you need to test into this field.
- `Test?`
  - Select yes or no to specify whether you want to test the UUT at this channel/frequency. If set to "Yes" then the channel will be tested. If set to "No" then channel/frequency will not be used. This is a shortcut to temporarily turning "on" and "off" channels in the table without creating a new test procedure.

Note

The following fields are not used in this software program and should be left empty:

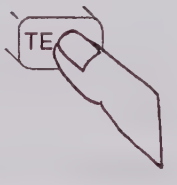
- `TX Chan Info`
- `RX Freq (MHz)`
- `TX Freq (MHz)`
- `Prime`

For information on saving the channel table, see *Saving a Test Plan* later in this chapter.

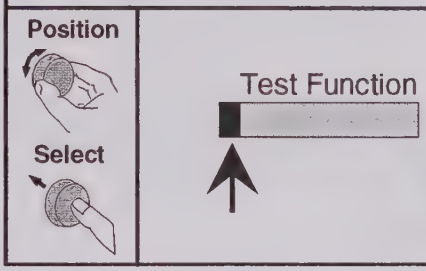
How to Specify Channel Information

1 *Press* **TESTS** *to display the* **TESTS** *screen.*

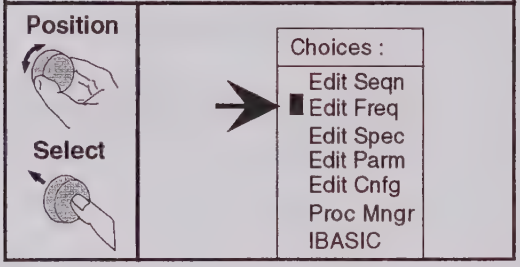
IF you're in **IBASIC**, *press* **SHIFT**, **CANCEL** *before pressing* **TESTS**.



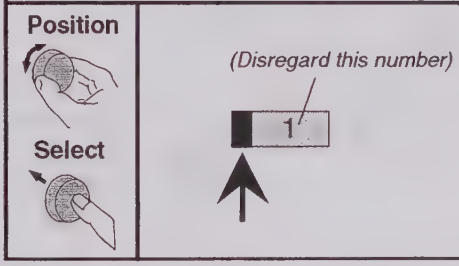
2 *Position cursor at* **Test Function** *and select it.*



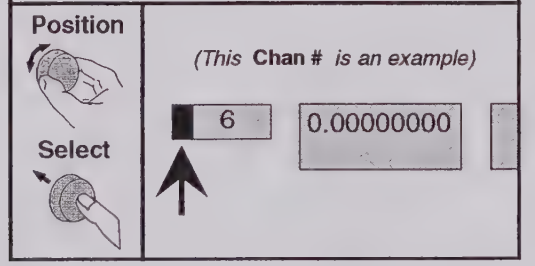
3 *Position cursor at* **Edit Freq** *and select it.*



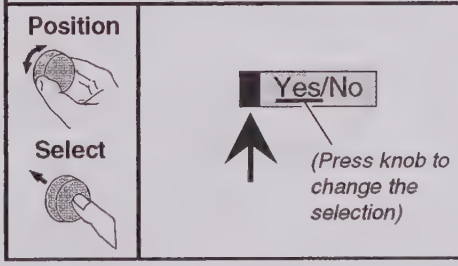
4 *Position cursor at* **Chan #** *field and select it.*



5 *Scroll to the desired* **Chan #** *and select it.*

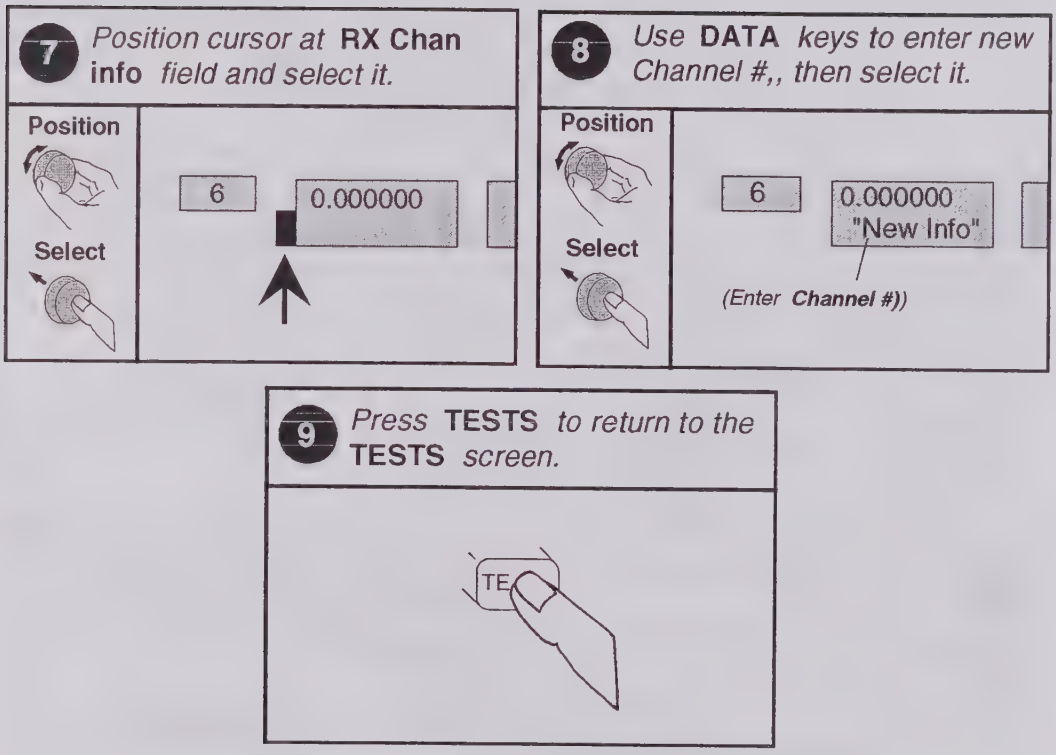


6 *Position cursor at* **Test?** *field and select* **Yes** *or* **No**.



FREQ1

Continue on next page


7
Position cursor at RX Chan info field and select it.
Position
Select
6
0.000000
8
Use DATA keys to enter new Channel #,, then select it.
Position
Select
6
0.000000
"New Info"
(Enter Channel #))
9
Press TESTS to return to the TESTS screen.
TE

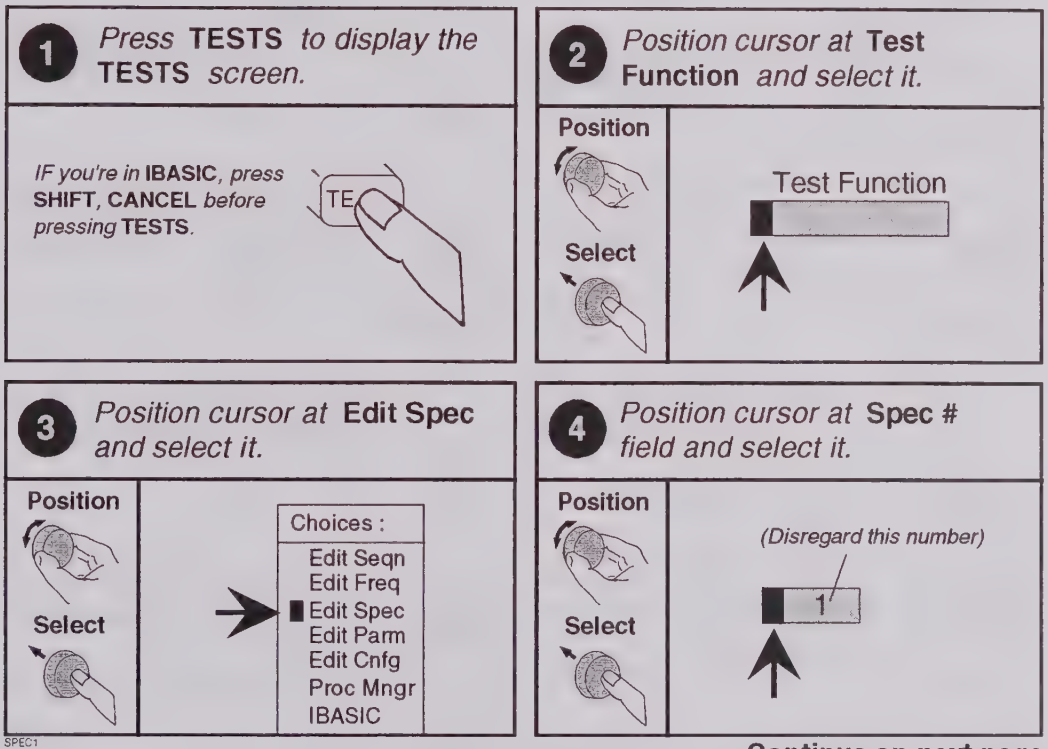
FREQ2

Changing Pass/Fail Limits (Edit Specifications)

Specifications are values that set pass/fail limits for tests. Default values are available in the test software. These default values may be changed to suit your particular requirements.

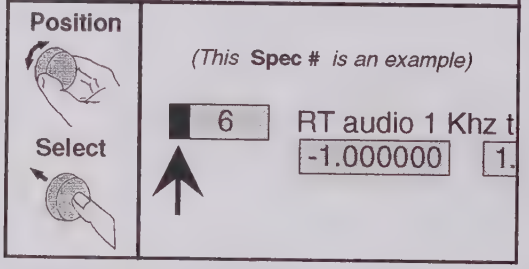
The following describes how to change the pass/fail (upper and lower) limits in the HP 8921A "Edit Specification" screen. See *Specifications* in chapter 4 for descriptions and default values for each specification. For information on saving customized specifications, see *Saving a Test Plan* later in this chapter.

How to Change Pass/Fail Limits

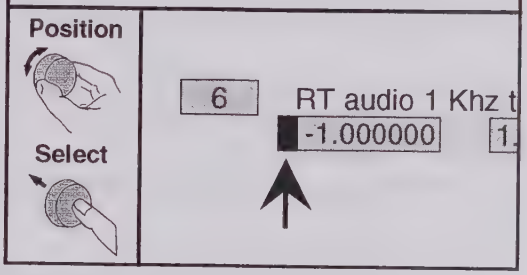


Continue on next page

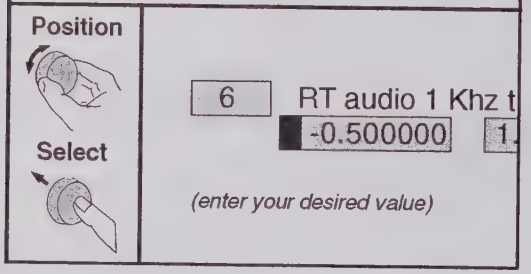
5 *Scroll to the desired* **Spec #** *and select it.*



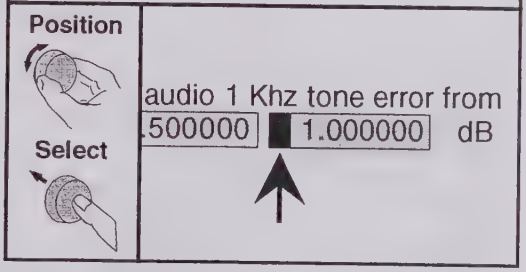
6 *Position cursor at* **Lower limit** *field and select it.*



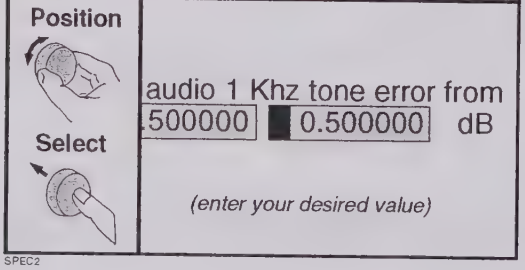
7 *Use* **DATA** *keys to enter new value, then select it.*



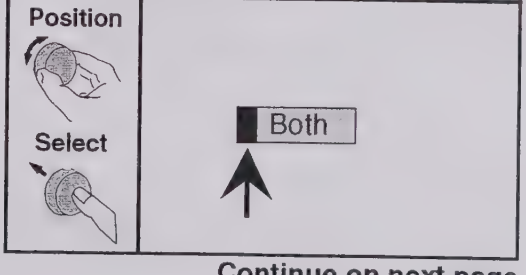
8 *Position cursor at* **Upper Limit** *field and select it.*



9 *Use* **DATA** *keys to enter new value, then select it.*

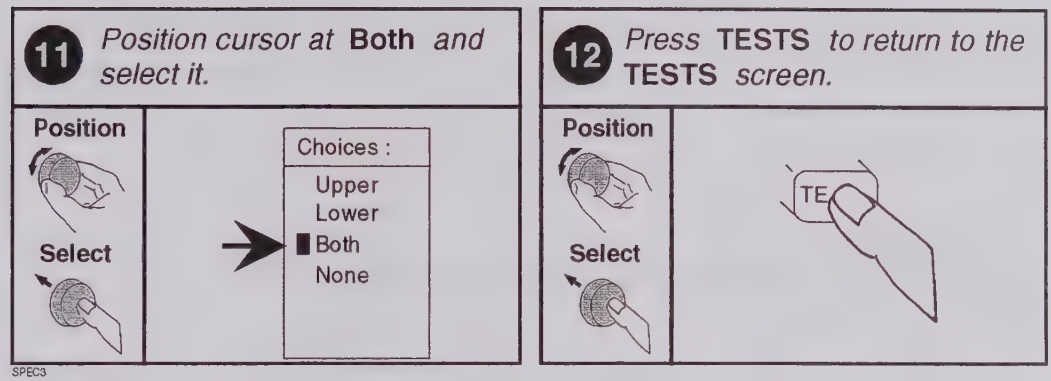


10 *Position cursor at* **Check field** *and select it.*



SPEC2

Continue on next page

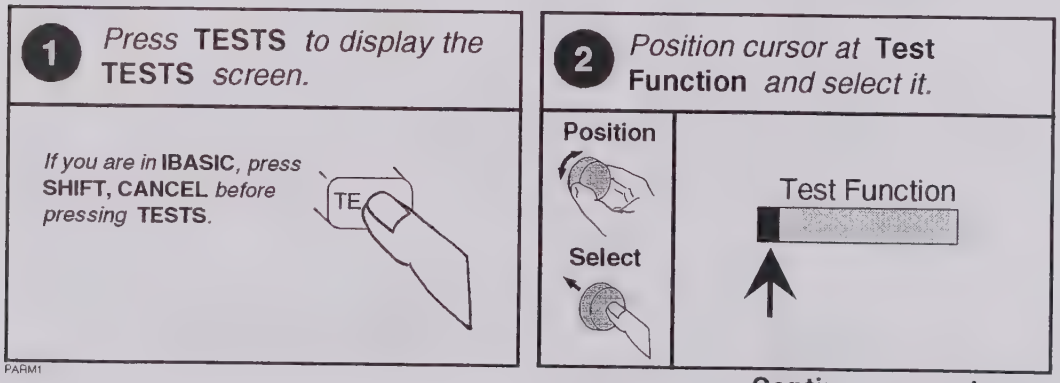

11
Position cursor at Both and select it.
Position
Select
Choices :
Upper
Lower
Both
None
12
Press TESTS to return to the TESTS screen.
Position
Select
TE
SPEC3

Changing the Test Environment and Conditions (Edit Parameters)

The software uses parameters to optimize the test environment and conditions for your testing situation. Many of the parameters are determined by examining your test needs. Other parameters are determined by performing measurements to calibrate items in your system. Examples of parameters include *RX RF level for SAT and ST detection, RX RSSI offset, TX path loss*, and a Demo Mode. The HP 11807B Software comes with default settings for parameters. The defaults should be reviewed for your particular needs. See *Parameters* in chapter 4 for descriptions and default values for each parameter. For information on saving customized parameters, see *Saving a Test Plan* later in this chapter.

The following describes how you can change parameters through the Edit Parameter screen to optimize your testing conditions.

How to Change the Test Environment and Conditions



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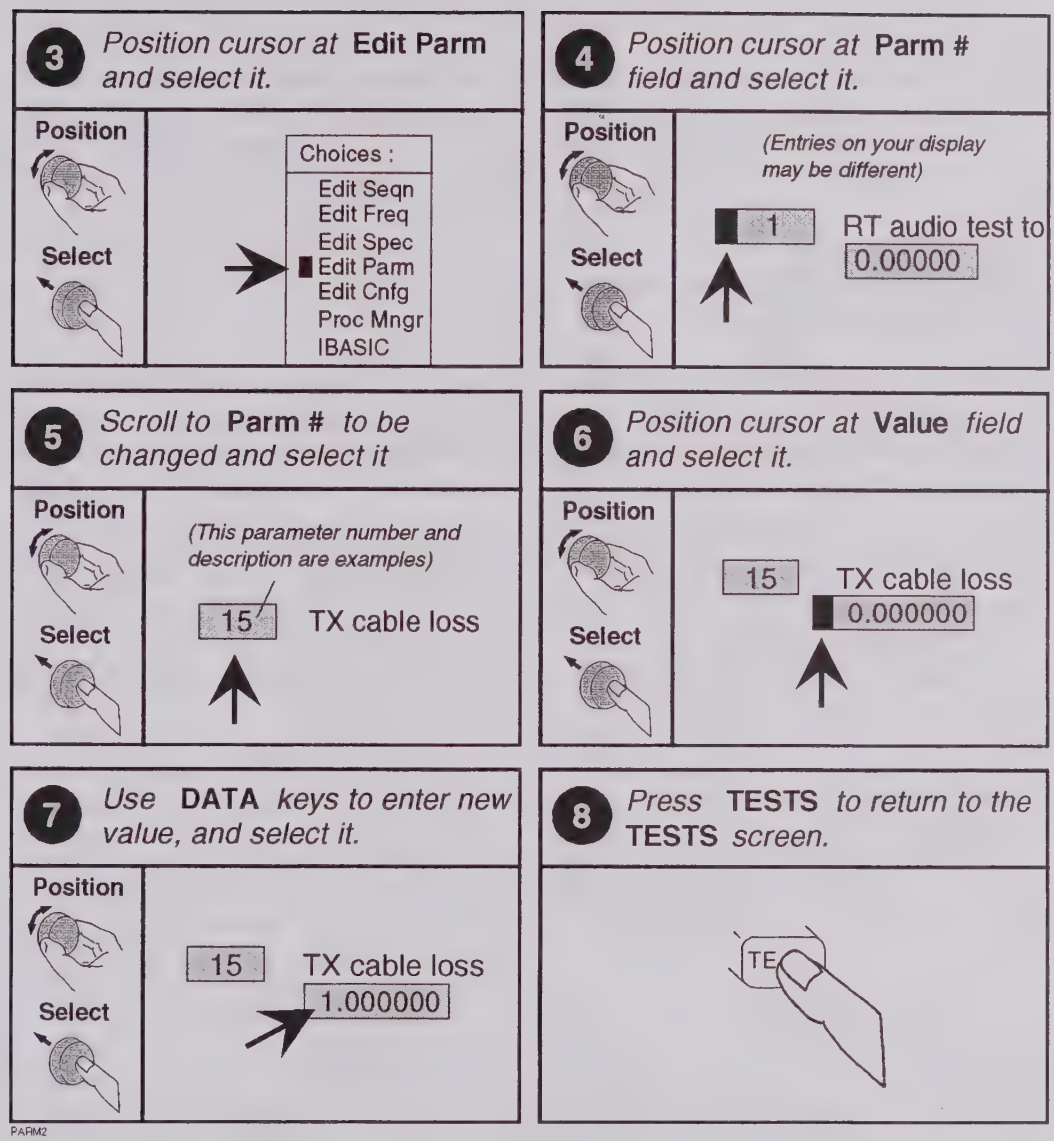

3 Position cursor at Edit Parm and select it.
Position
Select
Choices :
Edit Seqn
Edit Freq
Edit Spec
Edit Parm
Edit Cnfg
Proc Mngr
IBASIC
4 Position cursor at Parm # field and select it.
Position
Select
(Entries on your display may be different)
1
RT audio test to
0.00000
5 Scroll to Parm # to be changed and select it
Position
Select
(This parameter number and description are examples)
15
TX cable loss
6 Position cursor at Value field and select it.
Position
Select
15
TX cable loss
0.000000
7 Use DATA keys to enter new value, and select it.
Position
Select
15
TX cable loss
1.000000
8 Press TESTS to return to the TESTS screen.
TE
PARM2

Saving a Test Plan (Procedure) (Procedure Manager)

A Test Plan or Procedure is a collection of pass/fail limits (specifications), the test environment and conditions (parameters), and a TEST sequence, saved in a file that customizes the test software to a specific application. You may save the file to a memory card or disk.

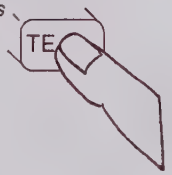
When you save a Procedure you will be saving parameters, specifications, and a test sequence, plus a library that contains the names of all parameters, specifications, and tests that are resident in the HP 11807B Software. The library file comes from the HP 11807B Software and cannot be modified. The library file will be automatically saved on the card or disk that is being used to store the new test procedure.

The following example shows how to save a new procedure to a memory card. For more information concerning procedures, see *Procedures* in the *Reference* Chapter 5.

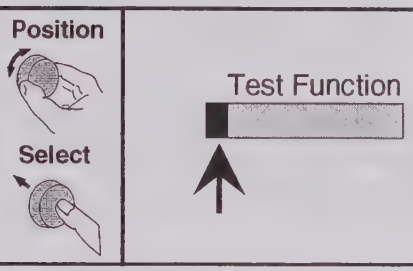
How to Save a Test Plan

1 *Press* **TESTS** *to display the* **TESTS** *screen.*

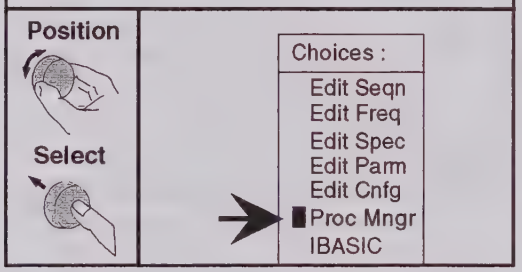
If you are in **IBASIC,** *press* **SHIFT, CANCEL** *before pressing* **TESTS.**



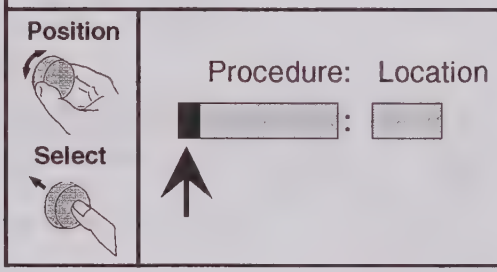
2 *Position cursor at* **Test Function** *and select it.*



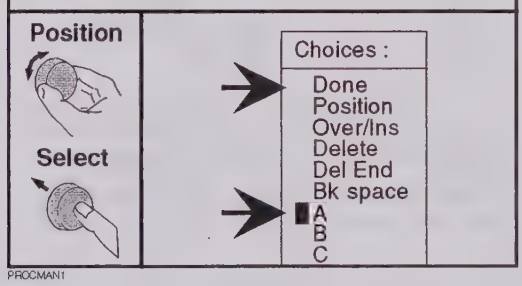
3 *Position cursor at* **Proc Mngr** *and select it.*



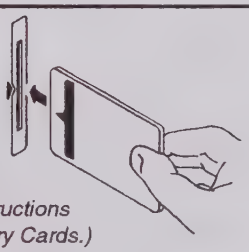
4 *Position cursor at* **Procedure** *field and select it.*



5 *Select characters to name the* **Procedure,** *then select* **Done.**



6 *Insert an initialized* **SRAM** *memory card.*

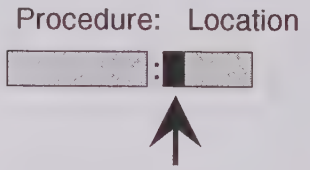


(For detailed memory card initialization instructions see Chapter 5-Memory Cards.)

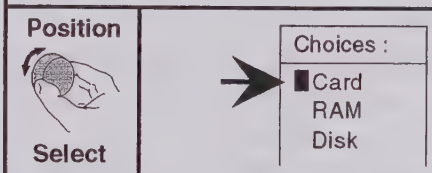
PROCMAN1

Continue on next page

7 *Position cursor at* **Location** *and select it.*

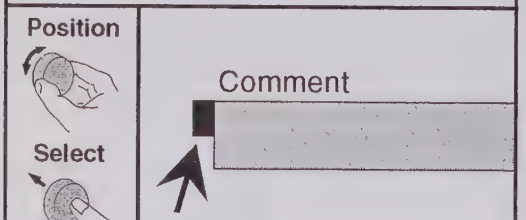


8 *Position cursor at* **Card** *and select it.*

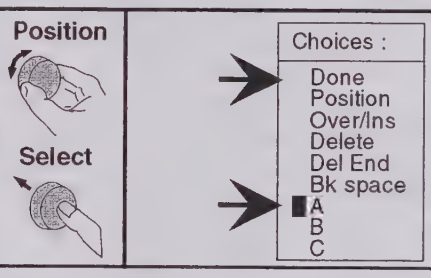


(You can also save procedures to an internal RAM disk or external disk drive. See Chapter 5-Disks.)

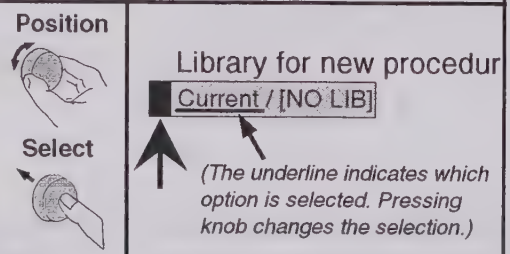
9 *Position cursor at* **Comment** *and select it.*



10 *Select characters for the* **Comment**, *then select* **Done.**

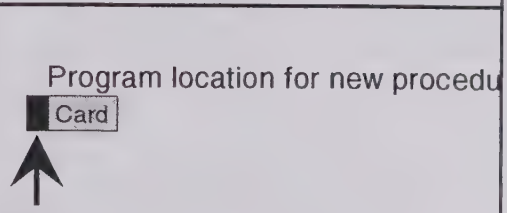


11 *Position cursor at* **Library for new p.... ,** *and select* **Current.**



(The underline indicates which option is selected. Pressing knob changes the selection.)

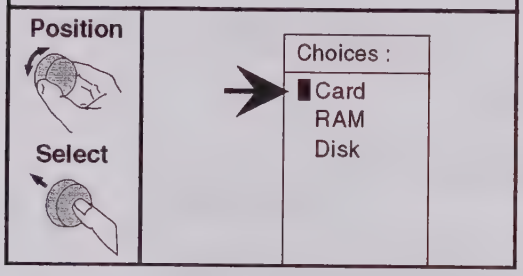
12 *Position cursor at* **Program location for .....** *and select it.*



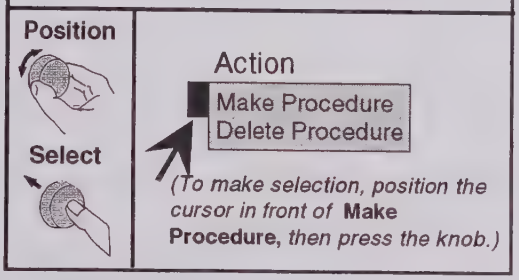
PROCMAN2

Continue on next page

13 *Position cursor at* **Card** *and select it.*

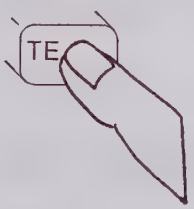


14 *Position cursor at* **Action** *and select* **Make Procedure**.



(To make selection, position the cursor in front of **Make Procedure,** *then press the knob.)*

15 *Press* **TESTS** *to return to the* **TESTS** *screen.*



To run the saved procedure;

1) Load the **Procedure**
2) Insert the original HP 11807B memory card
3) Press **Run Test**.

The original card contains the full program needed to allow your procedure to run.

PROCMAN3

Changing Test Execution Conditions

`Test Execution Conditions` define where and when test output occurs. You may decide to:

- Stop testing when a measurement fails or continue through all of the tests without stopping. Note: if `Stop` is selected and the program pauses as a result of this, you will be given a choice to continue, repeat the measurement, or go to the Laptop Emulator to send commands to the base station. (`On UUT Failure`)
- Display (or print) only measurements that fail, or display (or print) all measurements that pass or fail. (`Output Results`)
- Pause between each measurement, or run through entire test. Note: if `Single Step` is selected and the program pauses as a result of this, you will be given a choice to continue, repeat the measurement, or go to the Laptop Emulator to send commands to the base station. (`Run Mode`)
- Display output on CRT only, or display on CRT and print hardcopy. (`Output Destination`)

Note

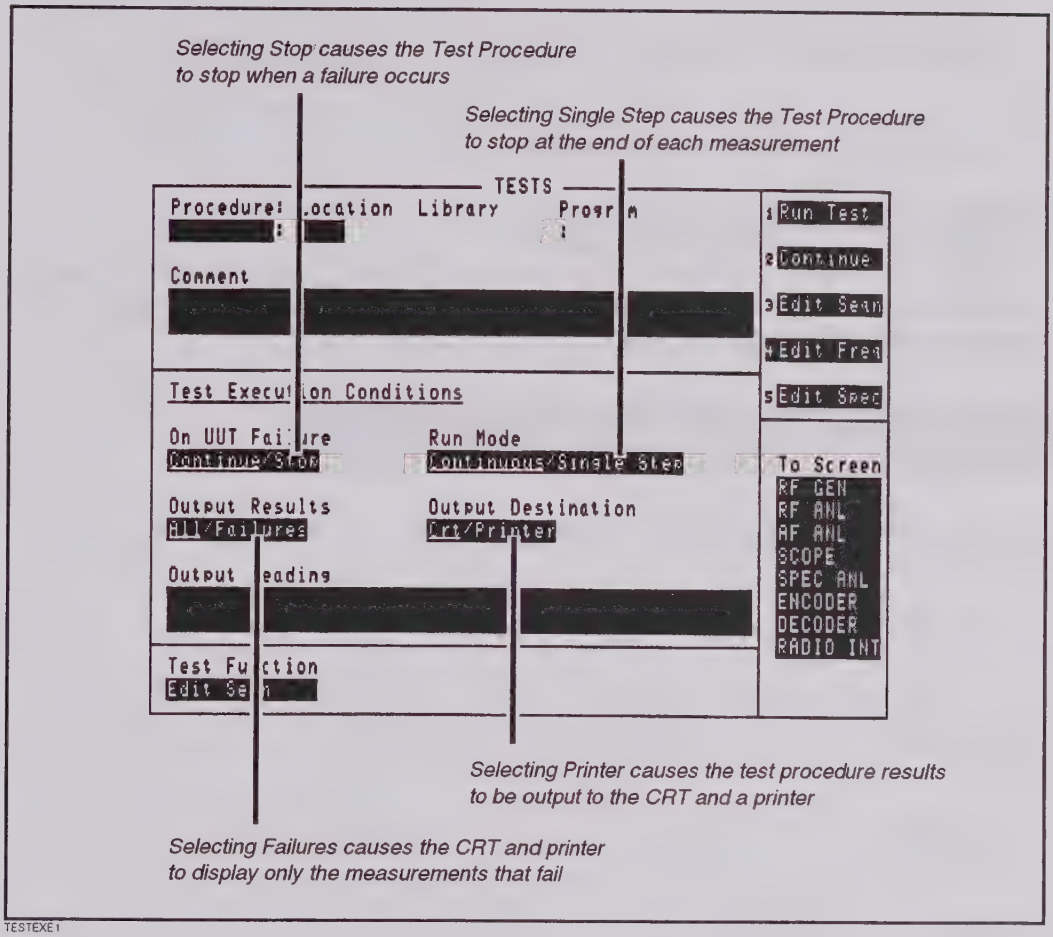
If printing test results is desired, after selecting `Printer` additional steps are necessary to connect and configure the printer. See *Printing* in chapter 5.

- Enter a title for an output heading for the displayed or printed results. (`Output Heading`)

`Test Execution Conditions` is located on the `TESTS` screen. Press (TESTS) to display them. To change a default setting, position the cursor to the desired field. Pressing the knob ("selecting") will toggle the underlined selection.

`Test Execution Conditions` settings are not retained after a power-down/ power-up cycle, and will return to their default settings.

How to Change Test Execution Conditions



TESTEXE1

Printing and Saving Test Results

Printing and saving test results are features of the HP 11807B software which require additional equipment and configuration. See *Printing* in chapter 5 for detailed descriptions and instructions for these features.

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Glossary G-1

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4

Test, Parameter, and Specification Descriptions

Tests are a series of measurements and one or more tests make up a procedure (see *chapter 3*). While you may change the tests that make up a procedure, you may not change the measurements the test will perform. Generally, the order in which the tests are run is not important.

This chapter describes each test and the associated parameters, specifications, and external equipment that are required. In this chapter, test descriptions with significant analyzer settings contain a section listing these settings. Tests that do not have relevant analyzer settings do not have an *Analyzer Settings* section. Many of the settings used by the software are determined by EIA standards and GE recommended procedures. See EIA and GE documentation for further detail on the methods of measurement.

The following types of settings are listed where they apply:

- IF Filter choices
- Audio filter choices
- Audio level detectors used
- Frequency counter gate times

The first few letters in the parameter, specification, and test names indicate what the item refers to:

- `GN` - General
- `RX` - Receiver
- `RX1` - Receiver 1
- `RX2` - Receiver 2
- `TX` - Transmitter
- `RT` - Receiver/Transmitter

Many of the Tests in the software perform a single measurement. Others make many measurements. Many measurements are contained in the following Tests:

- TEST_34 - TX operation tests
- TEST_35 - RX operation tests
- TEST_36 - RT combined oper and alignment test
- TEST_37 - RT system alignment
- TEST_38 - RT complete alignment
- TEST_39 - RT full parametric tests

TEST_34, 35, 37 and 38 correspond to three sections in the GE RCU and CRCU Maintenance Manual. See this manual for descriptions of these procedures.

TEST_36 - RT combined oper and alignment test (in the COMBINED Procedure) is an optimized sequence of tests, and allows you to do an extensive checkout of the RCU/CRCU with the least number of cable changes.

Testing Philosophy

This section offers a plan to maximize your testing efficiency. Use this section to customize a testing sequence for your needs.

Required Parameter and Specification Changes

Many parameters and specifications provide optional customization for your test procedure. The following parameters and specifications must be set to match your system requirements:

System Audio Level Parameters

- RX audio out CRCU LINE OUTPUT LEVEL (LOL)
- RX audio out RCU OUTPUT TEST LEVEL (OTL)
- TX audio in CRCU LINE INPUT LEVEL (LIL)
- TX audio in RCU INPUT TEST LEVEL(ITL)

The GE RCU Maintenance Manual specifies 0 dBm as the default value for the audio input (INPUT TEST LEVEL) and 0 dBm as the default value for the audio output (OUTPUT TEST LEVEL). The GE CRCU Maintenance Manual specifies -16 dBm as the default value for the audio input (LINE INPUT LEVEL) and -16 dBm as the default value for the audio output (LINE OUTPUT LEVEL). More than likely, these values will not meet your system requirements; therefore, you will have to enter the audio levels that meet your system needs. If you are using RCU's and CRCU's in the same site, you will probably want to set the audio levels to be the same for both.

System Deviation Parameters

- RX standard CRCU test level deviation
- RX standard RCU test level deviation

System Deviation Specifications

- TX voice deviation @ CRCU LINE INPUT LEVEL
- TX voice deviation @ RCU INPUT TEST LEVEL

The GE RCU Maintenance Manual specifies 6.1 kHz deviation as the default TX and RX deviation for the RCU. The CRCU default is specified to be 2.9 kHz deviation for both TX and RX deviations. Generally, you will want to enter the same deviation for TX and RX. Also, you will probably want to enter the same deviations for RCUs and CRCU's. Most systems deviations are either 6.1 to 6.2 or 2.9 kHz.

Test Bus Level Parameters

- RX audio test input lev for CRCU std dev
- RX audio test input lev for RCU std dev

The test bus input level is very important for setting up your RCU or CRCU. The test bus level is related to your system deviation. On the RCU, the test bus level is -1.5 dBm equivalent to 6.1 kHz deviation. On the CRCU, the test bus level is -17.5 dBm equivalent to 2.9 kHz deviation. The companded audio level difference between 6.1 kHz and 2.9 kHz deviation is 13 dB. Using 13 dB as the difference in audio level, the RCUs at 2.9 kHz deviation results in a test bus level of -1.5 dBm - 13 dB = -14.5 dBm. On the CRCU operated at 6.1 kHz deviation the test bus would be -17.5 dBm + 13 dB = -4.5 dBm. As you can see the test bus level for the CRCU and the RCU does not match. Therefore, if you are trying to match the audio levels for RCU's and CRCU's you must decide which type of base station to use as a standard. Under this circumstance, we recommend that it is better to use the RCU test bus level as the starting point. This would give a test bus level of -1.5 dBm for 6.1-6.2 kHz deviation and -14.5 dBm for 2.9 kHz deviation. It is our experience that the internal audio path on some RCU's would not adjust properly with a test bus level of -4.5 at 6.1 kHz deviation.

Recommended Parameter Changes

Power Level Parameters

- `TX power high level 0-7`
- `TX power low level 0-7`

It is very common that TX power levels can vary between cell sites so you should set the power level parameters to match your site power levels.

Path Loss Parameters

- `RX1 path loss`
- `RX2 path loss`
- `TX path loss`

Generally, cable loss should remain constant if you are always using the same cables. However, if you are using a different set of cables, measure the cable loss using TEST_47 *GN measure cable loss* and input the loss numbers into these parameters.

RSSI offset Parameter

- `RX RSSI offset`

If you are using offsets, you will need to enter the offset numbers for the site or sector into this parameter.

Default Procedure Descriptions

The HP 11807B Opt 041 software comes pre-programmed with six procedures. The following is a description of each of the procedures.

COMBINED

This procedure is a combination of the operational and alignment checks in the GE RCU and CRCU Maintenance Manual. The procedure does all the tests specified in the operational test, but it does them in an order and sequence that allows for adjustment and to speed automated testing. This procedure uses the audio loopback method for audio path alignment. This procedure uses audio levels of -8 dBm (default value suggested in the manual is 0 dBm) and an RSSI adjustment level of -90 dBm instead of -100 dBm.

COM_ALIGN

This procedure matches the complete alignment portion of the GE RCU and CRCU Maintenance Manual.

SYS_ALIGN

This procedure matches the system align portion of the GE RCU and CRCU Maintenance Manual.

TST_NO_LB

This procedure is a custom procedure which tests RCU's and CRCU's without using audio loopback. The test bus input is not used for this procedure. The system deviations are both set to 6.2 kHz deviation for both RCU's and CRCU's. The audio input level is set to -10 dBm and the audio output level is set to 0 dBm. For the TX limiting test, this procedure uses Compandor on and an audio level of 25 dB above the audio input level. The RSSI adjustment level is -90 dBm.

GE_LCR_R1 & GE_LCR_R2

This procedure should be used to check your Locating Receivers. RSSI is checked on several channels across the cellular band on one transceiver. The channel numbers on which to test come from the Edit Frequency table; thus, the user does not have to be prompted for a new channel number each time the channel is change. This test is done on a single receiver so that cabling does not have to be switched back and forth for each channel.

Alignment Approaches

There are two general approaches to choose from when aligning the RCU/CRCU. Procedures in the software are designed to implement them. The approaches are:

1. Perform the procedures described in the maintenance manual, aligning the RCU/CRCU so Loopback 3 or audio loopback can be used when performing System Alignment. The following Procedures are designed to use this loopback capability:
   a. `SYS_ALIGN` - System Alignment
   b. `COM_ALIGN` - Complete Alignment
   c. `COMBINED` - Combined
2. Perform procedures to test and align the receiver and transmitter separately without loopback. The following Procedure is designed to do this:
   a. `TST_NO_LB` - Test with No Loopback

Approach 1 allows System Alignment checks and line level changes without RF test equipment. After the RX audio gain (R43;RCU) is set using a fixed test bus input signal, you will be able to change the TX audio gain setting (R58;RCU) by measuring the line/audio output with Loopback 3 enabled.

In steps of Approach 1, the receiver output level is checked with an RF signal applied that has the standard test level deviation. An adjustment of RX gain (R13;RCU) will have to be made if the output level is out of specification. Similarly, adjustment of TX gain (R5;RCU) will have to be performed if the transmitter deviation is out of specification.

Transmitter limiting deviation is tested using a line/audio input level 20 dB above the level required to obtain the deviation set in the parameter `TX limiting reference deviation`. See the parameter `TX limit aud 25 dB above ITL` in *Parameters*, later in this chapter. The compandor is disabled while the limiting deviation is being measured.

Approach 2 allows you to make adjustments to RX audio gain (R43;RCU) and TX audio gain (R58;RCU) without doing loopback first. If you normally adjust R43 and R58 and not R13 and R5, this second approach will be a closer match to your alignment procedure.

Transmitter limiting deviation is tested using a line\audio input level 25 dB above the value entered into the parameter `TX audio INPUT TEST LEVEL`. See the parameter `TX limit aud 25 dB above ITL` *Parameters*, later in this chapter. The compandor is enabled while the limiting deviation is being measured.

Choosing a Sequence when Aligning

Certain TEST sequences will not properly perform alignment of the RX and TX audio paths. For example, adjustments made in TEST_11 - `TX voice dev & limiting by audio LB` must be performed prior to adjustments of SAT and data deviation. A sequence using loopback that insures proper transmitter alignment is:

1. Adjust R43 - line output, using TEST_12 - `RX audio/line output level`.
2. Adjust R13 - RX1 audio gain, using TEST_13 -`RX1 audio level`.
3. Adjust R13 - RX2 audio gain, using TEST_14 -`RX2 audio level`.
4. Adjust R5 - transmitter gain, using TEST_11 -`TX voice dev & limiting by audio LB`.
5. Adjust R136 - mod limiting, using TEST_11.
6. Adjust R58 - line output, using TEST_11.
7. Adjust R137 - data deviation using TEST_04 - `TX data deviation`.
8. Adjust R158 - SAT deviation, using TEST_03 - `TX SAT frequency error & deviation`.

If you are putting together a sequence with other TESTs that have adjustments in them, determine the adjustment that is being made, and place the TEST so that the sequence of adjustments described above is retained.

Saving all the cell site parameters on a card for later reuse

Since the configuration of each cell site is different, customizable software was made to handle the site variations. On the test screen you can customize your software procedures to correspond to each cell site configuration. You can change testing sequence, testing conditions, test channels and specifications to conform to your cell. Once you have created this customized procedure you will want to save this procedure for future maintenance of this cell site. See chapter 3 *Saving a Test Plan* for a description of saving the procedure. You may want to do this for each cell site.

Test SAT and ST at extremes

In congested areas such as cities, SAT and ST performance becomes very important. You may want to do more extensive testing of SAT and ST in this case. There is a parameter provided that tests SAT and ST at their extreme deviation limits. The parameter is *RX SAT & ST test @ extremes [0=no 1=yes]*.

RF and Audio Switching Arrangements (optional)

The HP 11807B Option 041 Cell Site Station Test Software supports two ways of switching RF and audio paths. The first uses the optional Test Set Radio Interface Card, and external switches. The second uses an HP 3488A Switch/Control Unit with optional internal switches. The main part of this manual describes the method using the Radio Interface Card. Appendix A describes the method using the HP 3488A.

The `COMBINED` and `TST_NO_LB` Procedures have TEST sequences that minimize changes to RCU and Test Set connections. If you are primarily running a sequence such as this, you will not find much benefit in automatically switching RF and audio paths. If you are developing your own sequence, or you are following the sequences in the GE RCU Maintenance Manual, you may find automatic switching helpful.

An RF splitter can be used to separate the DUPLEX OUTPUT signal and apply two signals at the same level simultaneously to the RX1 and RX2 receiver inputs.

You will have to determine the signal path loss from the DUPLEX OUTPUT to each of the RX1 and RX2 inputs and enter them into the parameters `RX1 (and RX2) path loss`. See *Determining Calibration Parameters* in chapter 2.

Switch Control Input Buffer (optional)

Depending on the loading of the switch control inputs, a buffer may be needed between the Radio Interface connector and the switches.

If a buffer is required, a 7407 non-inverting TTL buffer can be used. The buffer outputs must be pulled up to the 5 volt supply with
1000 Ω resistors.

There may be interface circuits described in the data sheet of the switch you select.

See *Radio Interface Connections* in chapter 2 for connector pinouts.

RF and Audio Switches (optional)

The Test Set Radio Interface Card has TTL and CMOS compatible outputs that control switches external to the Test Set. The switches can be activated automatically by the test software.

Caution **Damage to the Radio Interface Card**

Damage to the Test Set can result if the RF or audio switches generate transients that are conducted into the Test Set via the Radio Interface connector. It may be necessary to install diodes on the Radio Interface control lines to suppress transients caused by the switches. Refer to the switch manual for the proper interface to TTL or CMOS control lines.

An SPDT switch can be installed so that the test software can select either the transmitter AUDIO input (LINE INPUT) or the RCV TEST 1 input (test bus input) to be driven by the Test Set AUDIO OUT. A miniature SPDT printed-circuit-board-mounted relay provides the necessary characteristics.

An RF switch can be used to route the HP 8921A DUPLEX OUT to the RX1 or RX2 RCU connectors. The HP 8762A SPDT or the HP 8765A SPDT coaxial switches can be used. A switch control input buffer will be needed if you use these switches. See the switch data sheets for details on switching requirements.

Entering RCU/CRCU Information for Testing

When running a procedure, the first screen that appears is `RCU/CRCU Configuration, Setup and Testing`. Information which is important for testing is entered on this screen.

- Channel number
  - The channel to be tested is displayed in this field. However, to edit the channel number from this screen, the parameter `GN channel [Single=0 Edit Freq=1 LCR=2]` must be set to 0=`Single`.
- RCU
  - Pressing the knob will toggle the selection between Extended Frequency, Non-Extended Frequency, and Compact RCU. Press the knob until your desired selection is displayed.
- Power/External PA
  - If Extended Frequency or Non-Extended Frequency RCU was selected in the above field, Power will appear in this field. Pressing the knob will toggle the selection between Dynamic Level PA and Single Level PA. Press the knob until your desired selection is displayed.
  - If Compact RCU was selected in the above field, External PA will appear in this field. Pressing the knob will toggle the selection between Yes and No. Press the knob until your desired selection is displayed.
- Audio Board
  - If Extended Frequency or Non-Extended Frequency RCU was selected in the RCU field, this field will appear. Pressing the knob will toggle the selection between Old 19D901102G1 and New 19D901102G3. Press the knob until your desired selection is displayed.
- Display RCU test setup information
  - It is important for new users to read the information contained on this screen.
- Press `Begin Test` when all the above steps have been completed.

TEST_01 - TX RF power level

This test performs TX RF power measurements. The power levels at which the measurements are performed is determined by the transceiver type identified on the RCU/CRCU Configuration, Setup, and Testing Screen. For RCUs, four power levels are checked when Dynamic level PA is selected and one power level is checked when Single level PA is selected. For CRCU's, eight power levels are checked. These power level settings can be overridden to make fewer measurements by setting parameter TX power, test down to power level (0-7) to a number less than what is the number for the transceiver type.

If a power level needs adjustment, a meter will appear on the screen if parameter GN adjust [0=never 1=on fail 2=always] is set to 1=on fail or 2=always. For RCU's, pressing the Disp Loc key will show you which pot to adjust. Automatic power adjustment can be done on the CRCU by pushing Adj Power. After pushing Adj Power, select Adj Auto. This key will cause the software to automatically adjust the CRCU power to the desired power.

This test uses the parameters TX power high level (0-7) and TX power low level (0-7) to determine the absolute power at each power level. The limits on the acceptable power error at each level are determined by the specifications TX output power error at level (0-7).

Power measurement accuracy depends on the accuracy of the values you have obtained for losses and entered in the parameter TX path loss. Path losses may be measured using TEST_46 *GN measure cable loss*.

The transmitter is keyed and de-keyed automatically at the start and end of the measurement.

Parameters Used

- GN Channel [Single=0 Edit Freq=1 LCR=2]
- GN make adjust
- TX path loss
- TX power high level(s) 0-7
- TX power low level(s) 0-7
- TX power test single level

Specifications Used

- TX output power error at level(s) 0-7

TEST_02 - TX frequency error

This Test measures the transmitter frequency and compares the result to the specification `TX frequency error`. Frequency adjustments can be made on RCUs only, not on CRCUs.

The RCU adjustment location can be displayed on the Test Set CRT by pressing USER `Disp Loc` .

During this test, transmitter power is set to level 0, and FM deviation due to audio and SAT is turned off. The Test Set tune mode is set to `Auto`, so frequencies far from the assigned channel can be measured. If you are measuring the frequency of a transmitter with abnormally low power, the power must be at least 1 milliwatt for the frequency error to measure properly. The transmitter is keyed and de-keyed automatically at the start and end of measurement.

Analyzer Settings

- IF bandwidth: 230 kHz
- RF frequency count gate time = 50 ms

Parameters Used

- `GN Channel [Single=0 Edit Freq=1 LCR=2]`
- `GN make adjust audio only [0=no 1=yes]`
- `GN make adjust`

Specification Used

- `TX frequency error`

TEST_03 - TX SAT frequency error and deviation

This Test measures the transmitter's SAT frequency error and deviation at each of the SAT frequencies. The SAT Measurements are compared to specifications. SAT deviation adjustments can be made.

See figure 4-1 for a block diagram showing the SAT level adjustment.

Alignment and verification of SAT deviation is affected by alignment performed in TEST_11, and in TEST_06. Therefore, TEST_03 - `TX SAT frequency error & deviation` should be performed after TEST_11 and TEST_06.

Note

During Alignment: Sequence Is Important

Alignment of only part of the RCU can be performed while you run this Test. The steps you follow in this Test are not the same as those that perform full RCU alignment. Adjustments may be made that leave the RCU mis-aligned. For this reason, you will have to include other Tests with this one if you intend to perform RCU alignment. Other Tests provide the necessary step-by-step procedures to properly align the RCU.

While the meter is displayed, the TX SAT frequency is sequenced between the three SAT frequencies. Four deviation measurements are performed at each frequency before the next SAT frequency is set.

The adjustment location can be displayed on the Test Set CRT by pressing USER `Disp Loc`.

During this test, transmitter power is set to level 0. The Test Set tune mode is set to `Manual`, so the transmitter frequency must be within a few hundred kilohertz. The transmitter is keyed and de- keyed automatically at the start and end of measurement.

Analyzer Settings

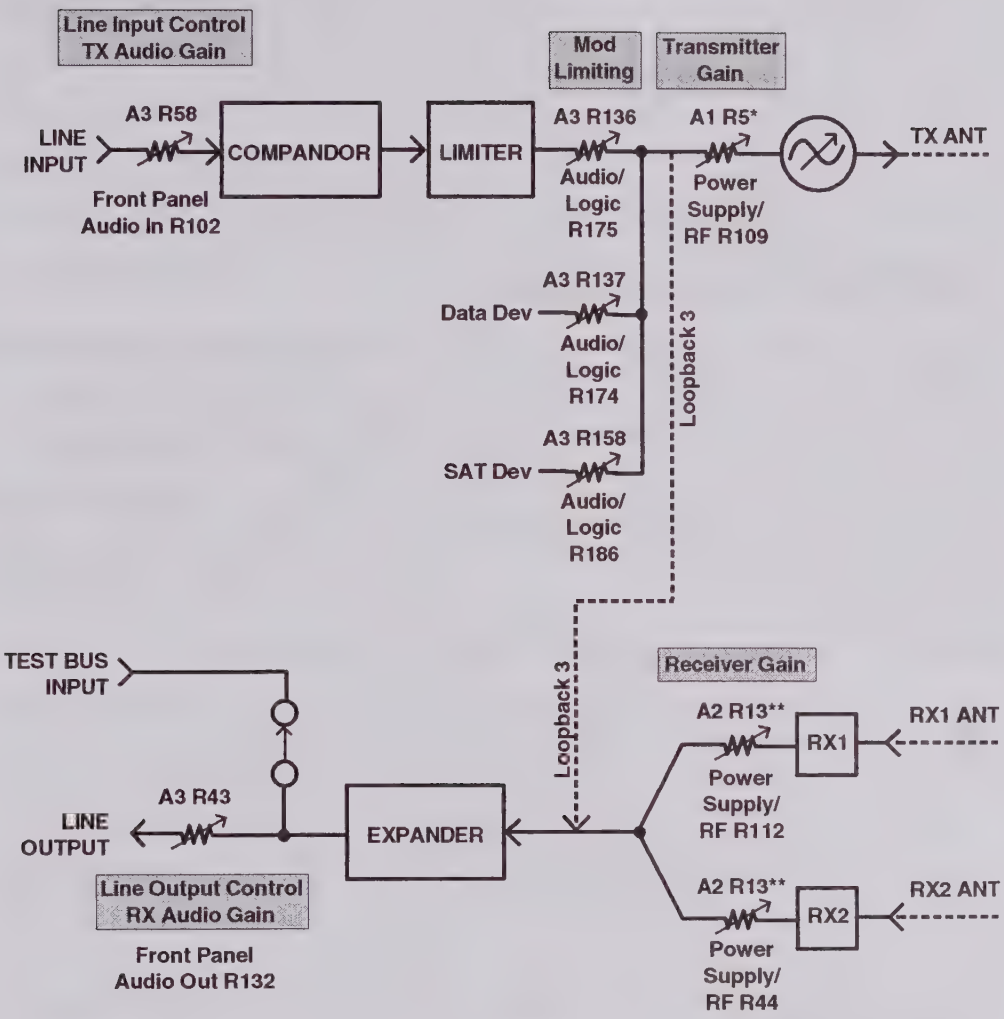
- IF bandwidth: 230 kHz
- Filter 1: 300 Hz HPF
- Filter 2: 15 kHz LPF
- Audio frequency measurement gate time = 1 s
- Detector: RMS (display is corrected to peak)
- De-emphasis: Off

Parameters Used

- `GN Channel [Single=0 Edit Freq=1 LCR=2]`
- `GN make adjust audio only [0=no 1=yes]`
- `GN make adjust`

Specifications Used

- `TX SAT deviation`
- `TX SAT frequency error`



* Replace R5 with R135 for a non-extended RCU.
** Replace R13 with R506 for a non-extended RCU.

Figure 4-1. RCU Audio Adjustments

TEST_04 - TX data deviation

This Test measures the transmitter wideband data deviation and compares the measurement to a specification. Data deviation adjustment can be made.

See figure 4-1 for a block diagram showing the data deviation adjustment.

Alignment and verification of data deviation is affected by alignment performed in TEST_11 - *TX voice dev & limiting by audio LB*. Therefore, if TEST_11 is being placed in a sequence, TEST_04 - *TX data deviation* should be performed after TEST_11.

Note

During Alignment: Sequence Is Important

Alignment of only part of the RCU can be performed while you run this Test. The steps you follow in this Test are not the same as those that perform full RCU alignment. Adjustments may be made that leave the RCU mis-aligned. For this reason, you will have to include other Tests with this one if you intend to perform RCU alignment. Other Tests provide the necessary step-by-step procedures to properly align the RCU.

The adjustment location can be displayed on the Test Set CRT by pressing USER `Disp Loc` .

During this test, transmitter power is set to level 0. The Test Set tune mode is set to `Manual`, so the transmitter frequency must be within a few hundred kilohertz. The transmitter is keyed and de- keyed automatically at the start and end of measurement.

Analyzer Settings

- IF bandwidth: 230 kHz
- Filter 1: 50 Hz HPF
- Filter 2: >99 kHz LPF
- Detector: Pk+-/2 (average of the positive and negative peak deviations)
- De-emphasis: Off

Parameters Used

- `GN Channel [Single=0 Edit Freq=1 LCR=2]`
- `GN make adjust audio only [0=no 1=yes]`
- `GN make adjust`

Specification Used

- `TX data deviation`

TEST_05 - TX voice deviation limiting

This Test measures the transmitter voice deviation during limiting and compares the measurement to a specification. Measurement of the peak+/- max deviation is made, and is checked to upper and lower specification limits. Alignment can be performed. Measurements of both peak +/- are also made and in this case only checked against the upper specification limit.

See figure 4-1 for a block diagram showing adjustments that affect the voice deviation.

Note

During Alignment: Sequence Is Important

Alignment of only part of the RCU can be performed while you run this Test. The steps you follow in this Test are not the same as those that perform full RCU alignment. Adjustments may be made that leave the RCU mis-aligned. For this reason, you will have to include other Tests with this one if you intend to perform RCU alignment. Other Tests provide the necessary step-by-step procedures to properly align the RCU.

One of two methods may be selected to test limiting.

The first method sets the line/audio input level 20 dB above the level that results in the onset of limiting. The value for the onset of limiting is set into the parameter `TX limiting reference deviation`. The transmitter distortion is checked at the onset of limiting to verify that limiting has started. If it has not, the TX input level is increased until limiting is detected with a distortion measurement.

The second method sets the line/audio input level 25 dB above the INPUT TEST LEVEL. The LINE INPUT LEVEL or INPUT TEST LEVEL is set into the parameters `TX audio in CRCU LINE INPUT LEVEL (LIL)` or `TX audio input RCU INPUT TEST LEVEL (ITL)`. This method is used when the parameter `TX limit aud 25 dB above ITL` is set to 1=`Yes`. This method is only recommended when the TX system deviation is around 6.1 kHz.

Limiting tests can be performed with the compandor enabled or disabled. However, the true peak deviation of the transmitter is best measured when the compandor is disabled, providing a lower input to the limiter. In this case, the

parameter TX limiting w/ compandor on should be set to 0=No . This is the default value.

Note

If you use the method of setting the limiting audio level to 25 dB above the ITL and compandor on, the voice limiting and voice deviation adjustments become interactive. Therefore, in this case the software is set up so that during the voice deviation adjustment you can also check the limiting adjustment by selecting the Adj Limit key. This only occurs on voice deviation so you should run voice limiting first then run voice deviation.

You may have to maximize the TX audio path gain before performing this measurement. If you set the parameter TX limit prompt user adj aud to 1=Yes , necessary steps will be displayed on the Test Set CRT. Follow these steps when you are aligning the RCU.

After performing a peak+/- max measurement, the peak+ and peak- deviation is measured and checked against an upper limit of the specification TX voice deviation limiting.

The modulation limiting adjustment can be performed using R136 for the RCU or R175 for the CRCU. The adjustment location can be displayed on the Test Set CRT by pressing USER Disp Loc .

During this test, transmitter power is set to level 0. The Test Set tune mode is set to Manual , so the transmitter frequency must be within a few hundred kilohertz. The transmitter is keyed and de- keyed automatically at the start and end of measurement.

Analyzer Settings

- IF bandwidth: 230 kHz
- Filter 1: 300 Hz HPF
- Filter 2: 3 kHz LPF
- Detector: Pk+-Max (maximum of the positive and negative peak deviations)
- De-emphasis: Off

Parameters Used

- GN Channel [Single=0 Edit Freq=1 LCR=2]
- GN make adjust audio only [0=no 1=yes]
- GN make adjust
- TX limiting w/ compandor on
- TX limit prompt user adj aud
- TX limit aud 25 dB above ITL
- TX limiting reference deviation
- TX audio in CRCU LINE INPUT LEVEL (LIL)
- TX audio input RCU INPUT TEST LEVEL (ITL)
- TX audio/line input impedance

Specification Used

- TX voice deviation limiting

TEST_06 - TX voice deviation (line input lev)

This Test measures the transmitter voice deviation and compares the measurement to a specification. The deviation is measured with the INPUT TEST LEVEL (RCU) or LINE INPUT LEVEL (CRCU) applied to the TX LINE INPUT.

Deviation can either be adjusted at the transmitter gain or at the line/audio input. The choice of adjustment is entered into the parameter `TX voice dev adj with R58 or R102`. Selecting `1=Yes` for this parameter will adjust the deviation at the line/audio input. Your choice depends on the approach you take when aligning the RCU. See *Alignment Approaches* earlier in this chapter.

Table 4-1. Adjusting Voice Deviation

Method of Adjustment	Extended RCU	Non-Extended RCU	CRCU
Transmitter gain	A1R5	RX1 R135	PS/RF R109
Line/audio input	A3R8	A3R58	Front Panel Audio In R102

See figure 4-1 for a block diagram showing the voice deviation adjustments.

Note

If you use the method of setting the limiting audio level to 25 dB above the ITL and compandor on, the voice limiting and voice deviation adjustments become interactive. Therefore, in this case the software is set up so that during the voice deviation adjustment you can also check the limiting adjustment by selecting the `Adj Limit` key. This only occurs on voice deviation so you should run voice limiting first then run voice deviation.

Note **During Alignment: Sequence Is Important**

Alignment of only part of the RCU can be performed while you run this Test. The steps you follow in this Test are not the same as those that perform full RCU alignment. Adjustments may be made that leave the RCU mis-aligned. For this reason, you may have to include other Tests with this one if you intend to perform RCU alignment. Other Tests provide the necessary step-by-step procedures to properly align the RCU.

During this test, transmitter power is set to level 0. The Test Set tune mode is set to `Manual`, so the transmitter frequency must be within a few hundred kilohertz. The transmitter is keyed and de- keyed automatically at the start and end of measurement.

Note

If the parameter `GN make adjust audio only` is set to 1=`yes`, the adjustment will only be done if the parameter `TX voice dev adj with R58 or R102` is set to 1=`yes`.

Analyzer Settings

- IF bandwidth: 230 kHz
- Filter 1: 300 Hz HPF
- Filter 2: 3 kHz LPF
- Detector: Pk+-/2 (average of the positive and negative peak deviations)
- De-emphasis: Off

Parameters Used

- GN Channel [Single=0 Edit Freq=1 LCR=2]
- GN make adjust audio only [0=no 1=yes]
- GN make adjust
- TX audio in CRCU LINE INPUT LEVEL (LIL)
- TX audio input RCU INPUT TEST LEVEL (ITL)
- TX audio/line input impedance
- TX voice dev adj with R58 or R102

Specification Used

- TX voice deviation @ CRCU LINE INPUT LEVEL
- TX voice deviation @ RCU INPUT TEST LEVEL

TEST_07 - TX audio frequency response

This Test measures the transmitter deviation at different audio frequencies and compares the measurement to a specification. During this test, transmitter power is set to level 0. The Test Set tune mode is set to `Manual`, so the transmitter frequency must be within a few hundred kilohertz. The transmitter is keyed and de- keyed automatically at the start and end of measurement.

The audio frequency endpoints of 300 Hz and 2.5 kHz are always measured. Frequencies above or below these frequencies are not measured.

Analyzer Settings

- IF bandwidth: 230 kHz
- Filter 1: 50 Hz HPF
- Filter 2: 15 kHz LPF
- Detector: RMS
- De-emphasis: Off

Parameters Used

- `GN Channel [Single=0 Edit Freq=1 LCR=2]`
- `TX audio frequency response step size`
- `TX audio/line input impedance`

Specification Used

- `TX audio response err from 6 dB/oct`

TEST_08 - TX audio distortion

This Test measures the distortion of the transmitter modulation at a 1 kHz rate and compares the measurement to a specification. During this test, transmitter power is set to level 0. The Test Set tune mode is set to `Manual`, so the transmitter frequency must be within a few hundred kilohertz. The transmitter is keyed and de- keyed automatically at the start and end of measurement.

Analyzer Settings

- IF bandwidth: 230 kHz
- Filter 1: C-Message
- Filter 2: >99 kHz LPF
- De-emphasis: Off
- Distortion Measurement: RMS

Parameters Used

- `GN Channel [Single=0 Edit Freq=1 LCR=2]`
- `TX audio/line input impedance`

Specification Used

- `TX audio distortion`

TEST_09 - TX hum and noise

This Test determines the ratio, in dB, of the modulated to un-modulated RMS FM deviations, and compares it to specifications.

During this test, transmitter power is set to level 0. The Test Set tune mode is set to `Manual`, so the transmitter frequency must be within a few hundred kilohertz. The transmitter is keyed and de- keyed automatically at the start and end of measurement.

This Test is run with two audio filter selections. First, a measurement is made with 50 Hz to 15 kHz filtering. Then, a C- Message filter is used. Separate specifications are used for each of the filter selections.

Analyzer Settings

- IF bandwidth: 230 kHz
- Filter 1: 50 Hz HPF, C-Message
- Filter 2: 15 kHz LPF, >99 kHz LPF
- De-emphasis: 750 μ s
- Measurement: RMS

Parameters Used

- `GN Channel [Single=0 Edit Freq=1 LCR=2]`
- `TX audio/line input impedance`

Specifications Used

- `TX hum and noise w/o C-Message filter`
- `TX hum and noise with C-Message filter`

TEST_10 - TX compandor response

This Test checks the performance of the TX compandor when the LINE INPUT level is set 20 dB below the level that results in a reference deviation. Under these conditions, the TX compandor should cause a 10 dB reduction in the deviation of the transmitter.

Analyzer Settings

- IF bandwidth: 230 kHz
- Filter 1: C-Message
- Filter 2: >99 kHz LPF
- De-emphasis: Off
- Measurement: RMS

Parameters Used

- `GN Channel [Single=0 Edit Freq=1 LCR=2]`
- `TX audio/line input impedance`

Specification Used

- `TX compandor resp when input red 20 dB`

TEST_11 - TX voice dev & limiting by audio LB

This Test provides for verification and alignment of the transmitter audio circuits that determine deviation and limiting. TEST_11 performs the sequence of steps for the RCU in the *GE RCU Maintenance Manual LBI 38220*, starting at "TRANSMIT PATH ALIGNMENT", and ending after step 15, before the point at which commands are sent to test data deviation. For the CRCU, the sequence follows the steps in the *CRCU Maintenance Manual LBI 38783*, starting at "TRANSMIT PATH ALIGNMENT", and ending with step 12.

See figure 4-1 for a block diagram showing audio level adjustments.

Note **During Alignment: Sequence Is Important**

Alignment of only part of the RCU can be performed while you run this Test. The steps you follow in this Test are not the same as those that perform full RCU alignment. Adjustments may be made that leave the RCU mis-aligned. For this reason, you will have to include other Tests with this one if you intend to perform RCU alignment. Other Tests provide the necessary step-by-step procedures to properly align the RCU.

RCU

During this Test, Loopback 3 in the RCU is used to connect the line/audio input to the line/audio output, with the TX compandor, TX limiter, and receive circuits in the path.

This Test provides for the adjustment of voice deviation using the transmitter gain, R5. If you do not normally adjust R5, or do not make audio adjustments using Loopback 3, then you should not place this Test in your sequence.

The receiver path must remain unchanged during this Test. R43, line output control, must not be adjusted. To insure that the receiver path is functioning properly and is adjusted, TEST_12 -RX audio/line output level should precede this Test.

At the start of the Test a prompt to set R58 and R136 will be displayed if the parameter TX limit prompt user adj aud has been set to 1=Yes. Adjustment location can be displayed by pressing USER Disp Loc.

After Loopback 3 is enabled, the line/audio input is automatically adjusted to produce the OUTPUT TEST LEVEL at the line/audio output. The OUTPUT TEST LEVEL can be entered as a parameter. Then, the loopback is disabled and the following Tests are run:

- TEST_06 - `TX voice deviation (line input lev)`
- TEST_05 - `TX voice deviation limiting`

TEST_06 is run with the line/audio input set to the level obtained during the loopback test. R5, transmitter gain, can be adjusted when the prompts are displayed. R136 and R58 must not be adjusted.

Then, TEST_05 is run and mod limiting, R136, can be adjusted. If R136 cannot be adjusted so that the specified limiting deviation is met, you may have to change the parameter `RX audio test bus input level`, and rerun receiver alignment - TEST_12. See the description of this parameter later in this chapter.

TEST_15 - `RX audio loopback` is then run to re-establish the correct setting for TX audio gain, R58, after the LINE INPUT level is changed from the level used in TEST_06 to the INPUT TEST LEVEL. The INPUT TEST LEVEL is applied to the line/audio input, and R58 is adjusted so the OUTPUT TEST LEVEL is measured at the line/audio output. Loopback 3 is again being used, this time to verify that the deviations measured in TEST_06 are restored after the line/audio input level change and the adjustment of R136.

CRCU

This test uses the CRCU audio loopback to connect the line/audio input to the line/audio output, with the TX compandor, TX limiter, and receive circuits in the path. This Test adjusts the voice deviation limiting at the transmitter modulator using the Transmitter gain adjustment PS/ RF R109. If you don't use loopback or adjust R109 you should not place this test in your sequence.

The receiver path must remain unchanged during this Test. R132, line output control, must not be adjusted. To insure that the receiver path is functioning properly and is adjusted, TEST_12 *RX audio/ line output level* should precede this Test.

At the start of the Test a prompt to set up the TX audio path will be displayed if the parameter `TX limit prompt user adj aud` has been set to 1=`Yes`. If you are testing CRCU's that have already been set up and are in operation, it is not necessary that you set up the audio path as describe in the prompt and you can just press `continue`. If this is generally the case for your CRCU's you may want to set the parameter to 0=`No` so that the testing will not stop at this prompt. In some cases, the TX audio path in a new or repaired CRCU may be significantly out of adjustment for your system audio levels. In this case, you may want to select `Align` at the prompt. Pressing `Align` requires that you maximize the modulation limiting control, R175, uses an audio/line input level of -20 dBm, and has you adjust the audio/line input lev R102. Selecting `Align` always causes you to do several adjustments. Whereas, just pressing `continue` may not require any adjustment, because the limiting control remains set and the audio/line input level is set to the LINE INPUT LEVEL for your system.

The first test performed as part of this is:

TEST_15 *RX audio loopback*. If alignment is not selected the test runs normally with the LINE INPUT LEVEL being used as the audio input level. The audio level is set to -20 dBm for this test if alignment is selected.

TEST_06 *TX voice deviation (line input lev)*. This test runs normally if alignment is not selected. If alignment is selected, the -20 dBm is used as the line/audio input level. It is important to note that the voice deviation for this test is adjusted with the Transmitter gain adjustment PS/ RF R109. This references the transmitter deviation to the LINE OUTPUT LEVEL.

TEST_05 *TX voice limiting*. If alignment is not chosen, then the limiting test is done according to the TEST_05 description. If alignment is chosen, the audio/line input is set to -20 dBm, the TX deviation is adjusted using the Front Panel Line/Audio In adjustment to the parameter `TX limiting reference deviation`, and then 20 dB is added to the input level. At this point the limiting deviation is measured and adjusted.

TEST_06 *TX voice deviation (line input lev)* This test is now repeated with the LINE INPUT LEVEL applied to the line/audio input regardless of whether align is set or not. Unlike the previous time this test is done, the TX deviation is done using the Front Panel Line/Audio In adjustment.

With the completion of this sequence of testing. The entire TX audio path is adjusted and reference to the RX audio path such that audio loopback between the TX and RX audio paths will be correct.

Both RCU and CRCU

The parameter `TX voice dev adj with R58 or R102` is over ridden in this Test. Prompts for the adjustment of R58 (RCU) or R102 (CRCU) front panel audio in will appear when needed.

Alignment and verification of SAT and data deviation is affected by the alignment performed in TEST_11. Therefore, TEST_03 - `TX SAT frequency error & deviation` and TEST_04 - `TX data deviation` should be performed after TEST_11.

After this Test is completed, System Alignment can be used to adjust R43 (RCU) or R132 (CRCU) audio out, and R58 (RCU) or R102 (CRCU) audio in if line levels need to change.

The purpose of this test is to completely align the audio path. Therefore, it does not make sense to run this test with the parameter `GN make adjust audio only` set to 1=`yes` .

Analyzer Settings

See the *Analyzer Settings* for Tests 05, 06 and 15.

Parameters Used

- GN Channel [Single=0 Edit Freq=1 LCR=2]
- GN make adjust audio only [0=no 1=yes]
- GN make adjust
- RX audio out CRCU LINE OUTPUT LEVEL (LOL)
- RX audio out RCU OUTPUT TEST LEVEL (OTL)
- RX audio test input level for CRCU std dev
- RX audio test input level for RCU std dev
- TX audio/line input impedance
- TX limit prompt user adj aud
- TX limiting w/ compandor on
- TX limit aud 25 dB above ITL
- TX limiting reference deviation

Specifications Used

- TX voice deviation @ CRCU LINE INPUT LEVEL
- TX voice deviation @ RCU INPUT TEST LEVEL
- TX voice deviation limiting
- RX audio loopback err from OTL or LOL

TEST_12 - RX audio line/output level

This Test provides for verification and alignment of the test bus input to line/audio output circuits.

See figure 4-1 for a block diagram showing audio level adjustments.

Note

During Alignment: Sequence Is Important

Alignment of only part of the RCU can be performed while you run this Test. The steps you follow in this Test are not the same as those that perform full RCU alignment. Adjustments may be made that leave the RCU mis-aligned. For this reason, you will have to include other Tests with this one if you intend to perform RCU alignment. Other Tests provide the necessary step-by-step procedures to properly align the RCU.

During the Test, a command is sent to connect the path from the test bus input to the line/audio output.

After the path is enabled, the test bus input level is set to the value in the parameter(s) `RX audio test input lev for CRCU std dev` or `RX audio test input lev for RCU std dev`. The sine wave rate of the is set to 1.004 kHz. The level at the line/audio output is measured. Adjustment of R43 (RCU) or front panel line out (CRCU), the line output control, can be performed.

The optimum test bus input level depends on your system audio levels. See system audio levels in the test philosophy. You may have to change the parameter that sets it. See the parameters *RX audio test input lev for CRCU std dev* or *RX audio test input lev for RCU std dev* later in this chapter.

The test bus input to line/audio output path is opened at the end of the Test.

Analyzer Settings

- Filter 1: 300 Hz HPF
- Filter 2: 3 kHz LPF
- De-emphasis: Off
- Measurement: RMS

Parameters Used

- GN Channel [Single=0 Edit Freq=1 LCR=2]
- GN make adjust
- RX audio test input lev for CRCU std dev
- RX audio test input lev for RCU std dev
- RX audio out CRCU LINE OUTPUT LEVEL (LOL)
- RX audio out RCU OUTPUT TEST LEVEL (OTL)

Specification Used

- RX audio loopback err from OTL or LOL

TEST_13 - RX1 audio level

This Test provides for verification and alignment of the RX1 RF input to line/audio output circuits. The audio output level can be adjusted at the Receiver 1 gain or at the line/audio output. Parameter `RX1 aud lev adj R43 or R132 [0=no 1=yes]` determines which method is chosen. Selecting `1=yes` will adjust the output level at the line/audio output. Your choice depends on the approach you take for aligning the RCU or CRCU. See *Alignment Approaches* earlier in this chapter.

Table 4-2. Adjusting Audio Output Level

Method of Adjustment	Extended RCU	Non-Extended RCU	CRCU
Receiver 1 gain	A2R13	RX1 R506	PS/RF R44
Line/audio output	R43	R43	Front Panel Audio Out R132

If the parameter `GN make adjust audio only` is set to `1=yes`, the adjust will only be done if the parameter `RX1 aud lev adj R43 or R132` is set to `1=yes`.

See figure 4-1 for a block diagram showing audio level adjustments.

Note

During Alignment: Sequence Is Important

Alignment of only part of the RCU can be performed while you run this Test. The steps you follow in this Test are not the same as those that perform full RCU alignment. Adjustments may be made that leave the RCU mis-aligned. For this reason, you will have to include other Tests with this one if you intend to perform RCU alignment. Other Tests provide the necessary step-by-step procedures to properly align the RCU.

If you are making adjustments, this Test should be run after TEST_12 - RX audio line/output level so that the receiver audio gain R43 (RCU) or R132 (CRCU) is properly set.

The RX1 RF input level is set -50 dBm. The modulation rate is set to 1.004 kHz. The deviation is set to that entered into the parameter(s) RX standard CRCU test level deviation or RX standard RCU test level deviation. The level at the line/audio output is measured and compared to the value in the parameter(s) RX audio out CRCU LINE OUTPUT LEVEL (LOL) or RX audio out RCU OUTPUT TEST LEVEL (OTL) using specification RX audio level err from OTL or LOL.

Analyzer Settings

- Filter 1: 300 Hz HPF
- Filter 2: 3 kHz LPF
- De-emphasis: Off
- Measurement: RMS

Parameters Used

- GN Channel [Single=0 Edit Freq=1 LCR=2]
- GN make adjust audio only [0=no 1=yes]
- GN make adjust
- RX audio out CRCU LINE OUTPUT LEVEL (LOL)
- RX audio out RCU OUTPUT TEST LEVEL (OTL)
- RX audio/line output impedance
- RX standard CRCU test level deviation
- RX standard RCU test level deviation
- RX1 path loss
- RX2 path loss

Specification Used

- RX audio level err from OTL or LOL

TEST_14 - RX2 audio level

See the Test description for TEST_13 -`RX1 audio level`. If you want to perform the RX2 level balance error test, place TEST_13 in a sequence before TEST_14. If the RX1 audio level is not determined prior to TEST_14 starting, the balance error test will not be performed. The audio level adjust can only be done at the RX2 gain.

TEST_15 - RX audio loopback

This Test checks the line input to line output path when Loopback 3 is enabled. The INPUT TEST LEVEL (RCU) or the LINE INPUT LEVEL (CRCU) is applied to the line/audio input, and the level at the line/audio output is checked. The absolute value for the line/audio output is the parameters `RX audio out CRCU LINE OUTPUT LEVEL` or `RX audio out RCU LINE OUTPUT LEVEL`.

The acceptable error for the absolute line/audio output level is contained in the specification `RX audio loopback err from OTL or LOL`. R58 (RCU) or R102 (CRCU), line input control can be adjusted.

See figure 4-1 for a block diagram showing audio level adjustments.

Note

During Alignment: Sequence Is Important

Alignment of only part of the RCU can be performed while you run this Test. The steps you follow in this Test are not the same as those that perform full RCU alignment. Adjustments may be made that leave the RCU mis-aligned. For this reason, you may have to include other Tests with this one if you intend to perform RCU alignment. Other Tests provide the necessary step-by-step procedures to properly align the RCU.

Analyzer Settings

- Filter 1: 300 Hz HPF
- Filter 2: 3 kHz LPF
- De-emphasis: Off
- Measurement: RMS

Parameters Used

- GN Channel [Single=0 Edit Freq=1 LCR=2]
- GN make adjust
- RX audio out CRCU LINE OUTPUT LEVEL (LOL)
- RX audio out RCU OUTPUT TEST LEVEL (OTL)
- RX audio/line output impedance
- TX audio in CRCU LINE INPUT LEVEL (LIL)
- TX audio input RCU INPUT TEST LEVEL (ITL)

Specification Used

- RX audio loopback err from OTL or LOL

TEST_16 - RX1 sensitivity

This Test checks the SINAD level at the line/audio output when an RF signal is applied to the RX1 RF input. The level applied to the RF input is determined by the values entered into the parameters `RX RF level for SINAD` and `RX1 Path loss`. The measured SINAD is compared to the value entered into the specification `RX SINAD`.

Analyzer Settings

- Filter 1: C Message
- Filter 2: >99 kHz LPF
- De-emphasis: Off
- Measurement: RMS

Parameters Used

- `GN Channel [Single=0 Edit Freq=1 LCR=2]`
- `RX RF level for SINAD`
- `RX1 Path loss`

Specification Used

- `RX SINAD`

TEST_17 - RX2 sensitivity

This Test checks the SINAD level at the line/audio output when an RF signal is applied to the RX2 RF input. The level applied to the RF input is determined by the values entered into the parameters `RX RF level for SINAD` and `RX2 Path loss`. The measured SINAD is compared to the value entered into the specification `RX SINAD`.

Analyzer Settings

- Filter 1: C Message
- Filter 2: >99 kHz LPF
- De-emphasis: Off
- Measurement: RMS

Parameters Used

- `GN Channel [Single=0 Edit Freq=1 LCR=2]`
- `GN make adjust audio only [0=no 1=yes]`
- `GN make adjust`
- `RX RF level for SINAD`
- `RX2 Path loss`

Specification Used

- `RX SINAD`

TEST_18 - RX1 signal strength indicator (RSSI)

This test determines the difference between the RSSI level reported by the RCU/CRCU and the level applied to the RX1 RF input. The RF level at which the test starts is the RSSI adjustment level and is determined by the parameter RX RSSI RF level for adj. If the parameter `RX RSSI check adj level only` is set to 0=`No`, then RSSI testing is performed in 10 dB steps form -30 to -110 dBm.

On the RCU, the adjustment is only done at the selected adjustment level. With the CRCU, the adjustment is done at the adjustment level and also at -40 dBm. When the meter is displayed for the CRCU, the -40 dBm adjustment is access by pressing `Chge Lev`. Generally, it will take several iterations between both levels to get the adjustments within the specification limits. The specification for the -40 dBm level is `RX RSSI reporting err @ -40 dBm CRCU adj`.

The software allows you to set an offset in the reported RSSI from the RCU/CRCU. The offset value is contained in the parameter `RX RSSI offset`. For example, if a -90 dBm RF level is applied to the RX1 RF input and you want the RCU/CRCU to report -95 dBm, you would add an offset of -5 dB. Setting an offset will cause compression of the RSSI linearity measurements at the high or low levels, and will thus effect the RSSI linearity specifications. RSSI offsets can not be set greater than +/- 15 dBm.

During the first RSSI measurement at the adjustment level, the actual reported RSSI level is displayed. Also at the adjustment level, the RSSI error is displayed and checked against the RSSI specification for that level. For the other RF levels only the RSSI error is displayed and checked against the RSSI specification for that level. If an offset is present, the offset value is displayed and the effects of the offset are removed from the RSSI error measurements. For example, if the RF level is -90 dBm, the offset is + 5 dBm, and the RCU/CRCU reported RSSI is -84, the displayed error from -90 dBm would only be +1. This eliminates the need for constantly adjusting the specification limits for new offsets.

Parameters Used

- GN Channel [Single=0 Edit Freq=1 LCR=2]
- GN make adjust audio only [0=no 1=yes]
- GN make adjust' *RX RSSI check adj level only [0=no 1=yes]
- RX RSSI offset'
- RX RSSI RF level for adj
- RX1 path loss

Specifications Used

- RX RSSI reporting err @ -40 dBm CRCU adj
- RX RSSI reporting error @ -30 dBm
- RX RSSI reporting error @ -40 dBm
- RX RSSI reporting error @ -50 dBm
- RX RSSI reporting error @ -60 dBm
- RX RSSI reporting error @ -70 dBm
- RX RSSI reporting error @ -80 dBm
- RX RSSI reporting error @ -90 dBm
- RX RSSI reporting error @ -100 dBm
- RX RSSI reporting error @ -110 dBm

TEST_19 - RX2 signal strength indicator (RSSI)

See the Test description for TEST_18 - RX1 signal strength indicator (RSSI), replacing RX1 with RX2.

TEST_20 - RX1 SAT detection

This Test checks the capability of the RCU to detect each of the three SAT frequencies. The frequencies are applied sequentially to the RF generator, and a Show Status command is sent to the RCU to determine the frequency detected.

The default entry for the parameter `RX RF level for SAT and ST detection` is -113 dBm. This value is a better one to use than the -116 dBm value used in some other RCU test procedures.

If the parameter `RX SAT and ST test @ extremes [0=no 1=yes]` is set to `1=yes`, the SAT detection will start at the SAT detection level, and step up in 10 dB steps until -30 dBm is reached.

Parameters Used

- `GN Channel [Single=0 Edit Freq=1 LCR=2]`
- `RX RF level for SAT and ST detection`
- `RX SAT & ST test @ extremes [0=no 1=yes]`
- `RX1 path loss`

Specification Used

There are no specifications used in this Test.

TEST_21 - RX2 SAT detection

See the Test description for TEST_20 - RX1 SAT detection, replacing RX1 with RX2.

TEST_22 - RX1 ST detection

This Test checks the ability of the RCU to detect the presence of a signaling tone on the input signal. The signal generator in the Test Set is modulated with a 10 kHz tone at a deviation of 8 kHz. The software sends a show status command to the base station and verifies that the RCU reports that a signaling tone has been sent.

If the parameter `RX SAT and ST test @ extremes [0=no 1=yes]` is set to `1=yes`, the ST detection will start at the ST detection level, and step up in 10 dB steps until -30 dBm is reached.

Parameters Used

- `GN Channel [Single=0 Edit Freq=1 LCR=2]`
- `RX RF level for SAT and ST detection`
- `RX SAT & ST test @ extremes [0=no 1=yes]`
- `RX1 path loss`

Specification Used

There are no specifications used in this Test.

TEST_23 - RX2 ST detection

See the Test description for TEST_22 - RX1 ST detection, replacing RX1 with RX2.

TEST_26 - RX1 audio frequency response

This Test measures the line/audio output level at different RX1 signal modulation rates and compares the measurement to a specification.

The audio frequency endpoints of 0.4 Hz and 2.5 kHz are always measured. Frequencies above or below these frequencies are not measured.

Analyzer Settings

- Filter 1: 50 Hz HPF
- Filter 2: 15 kHz LPF
- Detector: RMS
- De-emphasis: Off

Parameters Used

- GN Channel [Single=0 Edit Freq=1 LCR=2]
- RX audio frequency response step size
- RX standard CRCU test level deviation
- RX standard RCU test level deviation
- RX1 path loss

Specification Used

- RX audio response err from -6 dB/oct

TEST_27 - RX2 audio frequency response

See TEST_26 - RX1 audio frequency response, replacing the RX1 with RX2.

TEST_28 - RX1 audio distortion

This Test measures the distortion of the line/audio output signal at a 1 kHz rate and compares the measurement to a specification.

Analyzer Settings

- Filter 1: 300 Hz HPF
- Filter 2: 3 kHz LPF
- De-emphasis: Off
- Distortion Measurement: RMS

Parameters Used

- `GN Channel [Single=0 Edit Freq=1 LCR=2]`
- `RX1 path loss`

Specification Used

- `RX audio distortion`

TEST_29 - RX2 audio distortion

See TEST_28 - RX1 audio distortion, replacing the RX1 with RX2.

TEST_30 - RX1 hum and noise

This Test determines the ratio of the line/audio output voltages with and without modulation, and compares it to a specification.

Analyzer Settings

- Filter 1: C-Message
- Filter 2: >99 kHz LPF
- De-emphasis: Off
- Measurement: RMS

Parameters Used

- GN Channel [Single=0 Edit Freq=1 LCR=2]
- RX1 path loss

Specifications Used

- RX audio hum and noise

TEST_31 - RX2 hum and noise

See TEST_30 - RX1 hum and noise, replacing RX1 with RX2.

TEST_32 - RX expander

This Test checks the performance of the RX expander when the modulation level is reduced 10 dB from a deviation that is in the operational range of the expander. Under these conditions, the RX expander should cause a 20 dB reduction in the line/audio output level.

Adjustments are not prompted for during this Test.

Analyzer Settings

- Filter 1: 300 Hz HPF
- Filter 2: 3 kHz LPF
- De-emphasis: Off
- Measurement: RMS

Parameters Used

- `GN Channel [Single=0 Edit Freq=1 LCR=2]`
- `RX1 path loss`

Specification Used

- `RX expander resp when dev reduced 10 dB`

TEST_33 - RX SAT and ST Alignment

Note

This adjustment is done in the factory and is not usually required. If SAT and ST do not detect properly, you can use this test to align SAT and ST. This alignment can only be done on new RCU audio boards 19D9001102G3 or the CRCU 19D903242G1.

RCU

An RF signal at −50 dBm with a 6 kHz SAT tone at 2 kHz dev is applied to RX1. The voltage is measured on the 19D901102G3 audio board at TP35 and the user is prompted to adjust R253 (SAT frequency) for max voltage. The peak voltage limit is set by specification *RX SAT frequency adjustment level.* Next, the RF modulation is changed to 10 kHz with an 8 kHz deviation. The voltage at TP34 is maximized with R278 (ST freq). The minimum voltage at TP34 is defined by specification *RX ST frequency adjustment level.* The user is then prompted to set a fixed voltage at TP34 with R273. The default voltage is 5.6 Vp-p and is defined by specification *RX ST adjustment level.* The RF signal is then applied to RX2 and the voltage at TP34 is checked to see if it remains the same on the RX2 as it was in RX1. The upper and lower limits for this voltage are set to 5.6 Vp-p +/− 0.2 V is specification *RX ST adjustment level.* If the voltage is out of limits on RX2, the adjustment will be done again on RX2. In this case, the user should not center the adjustment at 5.6 Vp-p but only adjust it to just within the limits. This will minimize the effect on ST level when RX 1 is rechecked. If the user adjusted R273 on RX2, he will be prompted if he wants to check it again on RX1. The user will need to balance the ST level voltage reading so that it is within specification limits for both RX1 and RX2. The user can loop back to adjustment RX1 if RX2 is adjusted as many times as desired.

At the end of this alignment, the user will be prompted to see if he wants to run the SAT and ST tests (TEST_21, 23, 25, 20, 22, 24).

It is desirable to run these tests after making this adjustment. It may be good to also check SINAD and RSSI after this alignment.

CRCU

The adjustment procedure is the same for CRCU as the RCU with the exception of the following reference designators. The SAT frequency adjust is done on the audio/logic board TP2 with R283. The ST frequency adjust is done on the audio/logic board TP1 with R248. The ST level adjustment is done on the audio/logic board with TP1 with R253.

Note

Receiver audio alignment must be complete before doing this test. This test requires a 1:1 scope probe on the HI AUDIO IN to make measurements at test points on the 19D901102G3 (RCU) or 19D903242G1 (CRCU) audio board.

Analyzer Settings

- Filter 1: 300 Hz HPF
- Filter 2: 15 kHz LPF
- De-emphasis: off
- Measurement: Peak +-/ 2 (average of the positive and negative peaks)

Parameters Used

- GN Channel [Single=0 Edit Freq=1 LCR=2]
- RX1 path loss
- RX2 path loss

Specifications Used

- RX SAT frequency adjustment level
- RX ST frequency adjustment level
- RX ST adjustment level

TEST_34 - TX operation tests

This Test checks the RCU/CRCU transmitter by following the tests described in the "Transmitter Tests" part of the "OPERATIONAL TESTS" section of the GE RCU and CRCU Maintenance Manual.

The parameter `GN make adjust` should be set to 0=`No` to prevent the display of adjustment procedures. In TEST_34, Tests are not sequenced so that proper adjustment procedures can be performed. If you wish to perform alignment, use TEST_36 - `RT combined oper and alignment test`, TEST_37 - `RT system alignment`, or TEST_38 - `RT complete alignment`.

TEST_34 performs tests of the RCU/CRCU using the following sequence of Tests:

- TEST_01 - TX RF power level
- TEST_02 - TX frequency error
- TEST_03 - TX SAT frequency error and deviation
- TEST_04 - TX data deviation
- TEST_05 - TX voice deviation limiting
- TEST_06 - TX voice deviation (line input lev)

See the descriptions of these Tests in this chapter.

TEST_35 - RX operation tests

This Test checks the RCU/CRCU receiver by following the tests described in the "Receiver Tests" part of the "OPERATIONAL TESTS" section of the GE RCU and CRCU Maintenance Manual.

The parameter `GN make adjust` should be set to 0=`No` to prevent the display of adjustment procedures. In TEST_35, Tests are not sequenced so that proper adjustment procedures can be performed. If you wish to perform alignment, use TEST_36 - `RT combined oper and alignment test`, TEST_37 - `RT system alignment`, or TEST_38 - `RT complete alignment`.

TEST_35 performs tests of the RCU/CRCU using the following sequence of Tests:

- TEST_12 - RX audio/line output level
- TEST_13 - RX1 audio level
- TEST_14 - RX2 audio level
- TEST_15 - RX audio loopback
- TEST_16 - RX1 sensitivity
- TEST_17 - RX2 sensitivity
- TEST_18 - RX1 signal strength indicator (RSSI)
- TEST_19 - RX2 signal strength indicator (RSSI)
- TEST_20 - RX1 SAT detection
- TEST_21 - RX2 SAT detection
- TEST_22 - RX1 ST detection
- TEST_23 - RX2 ST detection
- TEST_24 - RX1 SAT and ST falsing
- TEST_25 - RX2 SAT and ST falsing

See the descriptions of these Tests in this chapter.

TEST_36 - RT combined oper and alignment test

This Test checks the operation of the RCU/CRCU and provides alignment procedures by combining parts of the "OPERATIONAL TESTS", "SYSTEM ALIGNMENT", and the "COMPLETE ALIGNMENT" sections of the GE RCU and CRCU Maintenance Manual. TX and RX Tests of distortion, hum and noise, frequency response and expander/compandor tests are not performed in this Test. They are included in TEST_39 - `RT full parametric tests`.

The sequence of Tests has been designed to result in a low level of operator intervention to change cables and make adjustments.

TEST_36 performs tests of the RCU/CRCU using the following sequence of Tests:

- TEST_12 - RX audio line/output level
- TEST_13 - RX1 audio level
- TEST_16 - RX1 sensitivity
- TEST_18 - RX1 signal strength indicator (RSSI)
- TEST_20 - RX1 SAT detection
- TEST_22 - RX1 ST detection
- TEST_24 - RX1 SAT and ST falsing
- TEST_14 - RX2 audio level
- TEST_17 - RX2 sensitivity
- TEST_19 - RX2 signal strength indicator (RSSI)
- TEST_21 - RX2 SAT detection
- TEST_23 - RX2 ST detection
- TEST_25 - RX2 SAT and ST falsing
- TEST_11 - TX voice dev & limiting by audio LB
- TEST_04 - TX data deviation
- TEST_03 - TX SAT frequency error & deviation

- TEST_02 - TX frequency error
- TEST_01 - TX RF power level

See the descriptions of these Tests in this chapter.

TEST_37 - RT system alignment

This Test provides for alignment of the RCU/CRCU by following the procedures in the "SYSTEM ALIGNMENT" section of the GE RCU and CRCU Maintenance Manual.

If you select the procedure that runs this test (SYS_ALIGN), the specifications will match the limits in the maintenance manual. If you are running this test from another procedure, you will need to verify the specification limits.

TEST_37 performs tests of the RCU using the following sequence of Tests:

- TEST_12 - RX audio line/output level
- TEST_15 - RX audio loopback

TEST_37 performs tests of the CRCU using the following sequence of Tests:

- TEST_06 - TX voice deviation (line input lev)
- TEST_15 - RX audio loopback

See the descriptions of these Tests in this chapter.

TEST_38 - RT complete alignment

This Test provides for alignment of the RCU/CRCU by following the procedures in the COMPLETE ALIGNMENT section of the GE RCU/CRCU Maintenance Manual.

If you select the procedure that runs this test (COM_ALIGN), the specifications will match the limits in the maintenance manual. If you are running this test from another procedure, you will need to verify the specification limits.

TEST_38 performs tests of the RCU/CRCU using the following sequence of Tests:

- TEST_12 - RX audio line/output level
- TEST_13 - RX1 audio level
- TEST_18 - RX1 signal strength indicator (RSSI)
- TEST_19 - RX2 signal strength indicator (RSSI)
- TEST_14 - RX2 audio level
- TEST_11 - TX voice dev & limiting by audio LB
- TEST_04 - TX data deviation
- TEST_03 - TX SAT frequency error & deviation
- TEST_02 - TX frequency error

See the descriptions of these Tests in this chapter.

TEST_39 - RT full parametric tests

This Test provides for checkout and alignment of the RCU/CRCU similar to the TEST_36 - `RT combined oper and alignment test`, with additional performance tests. TX and RX Tests of distortion, hum and noise, frequency response, and expander/compandor tests are performed in this Test. You may wish to run this Test if you have performed repair to the RCU/CRCU and would like to perform a full checkout.

TEST_39 performs tests of the RCU/CRCU using the following sequence of Tests:

- TEST_01 - TX RF power level
- TEST_12 - RX audio line/output level
- TEST_13 - RX1 audio level
- TEST_14 - RX2 audio level
- TEST_11 - TX voice dev & limiting by audio LB
- TEST_04 - TX data deviation
- TEST_03 - TX SAT frequency error & deviation
- TEST_07 - TX audio frequency response
- TEST_08 - TX audio distortion
- TEST_09 - TX hum and noise
- TEST_10 - TX compandor response
- TEST_26 - RX1 audio frequency response
- TEST_28 - RX1 audio distortion
- TEST_30 - RX1 hum and noise
- TEST_16 - RX1 sensitivity
- TEST_27 - RX2 audio frequency response
- TEST_29 - RX2 audio distortion
- TEST_31 - RX2 hum and noise
- TEST_17 - RX2 sensitivity

- TEST_32 - RX expander
- TEST_18 - RX1 signal strength indicator (RSSI)
- TEST_20 - RX1 SAT detection
- TEST_22 - RX1 ST detection
- TEST_24 - RX1 SAT and ST falsing
- TEST_19 - RX2 signal strength indicator (RSSI)
- TEST_21 - RX2 SAT detection
- TEST_23 - RX2 ST detection
- TEST_25 - RX2 SAT and ST falsing
- TEST_02 - TX frequency error

See the descriptions of these Tests in this chapter.

TEST_40 - GN Laptop Emulator

This Test can be used to send the RCU or CRCU commands and to display responses. After the Test is started, commands are listed on the left side of the display and can be chosen and sent to the RCU by rotating and pressing the knob.

Select the command `H` for the full names of the commands that are abbreviated on the CRT display. This command displays the RCU/CRCU help menu. For testing the RCU, press USER `Page Down` twice to display `H` in the list. For testing the CRCU, press USER `Page Down` three times to display `H` in the list. Repeatedly send `H` until the command information you are looking for is displayed.

After messages have scrolled past the top of the message display, they cannot be retrieved by the Test Set for subsequent viewing.

The RCU/CRCU is controlled using the Test Set Serial B port. The configuration of this port is set by the test software. Entries to the CONFIGURE screen of the Test Set do not affect the setup of the Serial B port. The following settings are made by the test software:

- Baud rate: 9600
- Data bits: 7
- Parity: Odd
- Stop bits: 1
- Receive Pace: None
- Transmit Pace: Xon/Xoff

Exiting TEST_40

Select Done from the command list to begin running the next Test in your sequence to return to regular testing, or to stop the program if no additional Tests have been entered. When you select Done, you will be prompted to repeat the test or to continue. Any changes you have made to the state of the RCU or CRCU will not be restored upon exiting. If you want to continue testing with the old RCU state, you must restore the RCU to that beginning state.

Parameters Are Not Used

There are no parameters used in TEST_40.

TEST_41 - GN standard configuration setup

This Test displays an arrangement of connections to the RCU and Test Set. If you are using a sequence of Tests other than those in the supplied Procedures, you may wish to place this Test at the start your sequence. It will provide the necessary prompts for many of the equipment connections.

This Test displays the following setup:

- TX high power output connection
- RX1 input connection
- LINE INPUT connection
- LINE OUTPUT connection

TEST_42 - GN standard test bus config setup

This Test displays an arrangement of connections to the RCU and Test Set. If you are using a sequence of Tests other than those in the supplied Procedures, you may wish to place this Test at the start of your sequence. It will provide the necessary prompts for some of the equipment connections.

This Test displays the following setup:

- TX high power output connection
- RX1 input connection
- TEST BUS INPUT connection
- LINE OUTPUT connection

TEST_43 - GN External Switch Control

This test can be used to manually control RF switches in your system. The RF switches can be ones controlled by the optional Radio Interface Card or switches in the HP 3488A.

Place this test as the only test in a sequence, or at a point in your sequence when you have to manually control a switch.

This test is added so that you can manually control the switches to any position to calibrate your cables. Therefore, you will probably want to make a test sequence with this test first followed by the GN measure cable loss test. Repeat these two tests in the sequence for as many switch positions you wish to calibrate.

This test will not successfully run unless your switches are configured with entries on the TESTS(`Edit Configuration`) screen. See *Configuration* in chapter 5.

Analyzer Settings

There are no relevant Analyzer settings made during this test.

Parameters Used

There are no parameters used in this test.

Specifications Used

There are no specifications used in this test.

TEST_44 - GN Swept Return Loss

Note

Test Signal Can Cause Interference

This test radiates a test signal when it is used to test antennas or cables with antennas attached to them. Verify that the level and frequency span used for the test cannot result in interference to another antenna nearby. Set the parameter *GN lev for VSWR and cable loss tests (dBm)* for the minimum level that provides good resolution for the measurement you are making. Set the frequency range carefully.

After a single sweep is taken, the tracking generator RF level is not changed. A CW signal is therefore being applied to the antenna.

If you are in an area with other receive antennas nearby, you may want to use *TEST_45 GN Discrete Return Loss*. This test measures the return loss at a frequency offset from a selectable range of AMPS channels. The offset (in kHz) from the AMPS channels can be set.

This test measures the return loss of a cable or device in the swept mode. A SWR bridge and a 6-dB pad are connected to the Test Set. The pad is used to improve the mismatch between the SWR bridge and the ANT IN port on the Test Set. The user is prompted at the start of the test to enter the start and stop frequencies. A reference level is measured with a short or open and the return loss is measured with the cable or antenna-under-test. The trace showing return loss over the frequency band selected is displayed on the screen. The measurement value returned is the worst case return loss in the sweep.

A single sweep is taken shortly after the test starts. The RF level of the signal generator is subsequently kept at the test level.

The trace can be viewed real time at the end of the test by pressing (CANCEL), (TESTS), and selecting `Spec Anl` from the `To Screen` menu. To print this screen, press (SHIFT) (PRINT) (a compatible printer must be connected, and the Test Set must be configured appropriately. See *Printing* in chapter 5.

VSWR can be calculated from the return loss. The following table contains some of the values from a calculation.

Table 4-3. Return Loss (0 to 20 dB) to VSWR

Return Loss(dB)	0	2	4	6	8	10	12	14	16	18	20
VSWR	infinity	8.7	4.4	3.0	2.3	1.92	1.67	1.50	1.38	1.29	1.22

Table 4-4. Return Loss (20 to 40 dB) to VSWR

Return Loss(dB)	20	22	24	26	28	30	32	34	36	38	40
VSWR	1.22	1.17	1.13	1.11	1.08	1.07	1.05	1.04	1.03	1.03	1.02

The following formula can be used to determine the VSWR from the return loss (=RL in dB):

$$VSWR = \frac{1 + 10^{\frac{-RL}{20}}}{1 - 10^{\frac{-RL}{20}}}$$

VSWR is sometimes stated as a ratio. For example: 1.2:1 or "one point two to one" VSWR. The first number is given in the tables and formula. The second number is always one.

Estimating Antenna Return Loss

If you are measuring the return loss of an antenna connected to the end of a known good feed line, you can approximately determine the return loss of the antenna by subtracting twice the line loss. For example, if you measure a return loss of 24 dB and the line is known to have 2 dB loss, the estimated return loss of the antenna is 20 dB. This estimate is in error if the coaxial line and connectors do not have a return loss somewhat greater than 24 dB.

Analyzer Settings

There are no relevant analyzer settings in this test.

Parameters

- GN lev for VSWR and cable loss tests

Specifications

- GN VSWR for swept return loss

TEST_45 - GN Discrete Return Loss

This test measures the return loss for discrete channels. This test is performed at channels entered by the user and offset by a frequency to make the measurement between actual channels. A reference level is measured on the spectrum analyzer with a short or open on the SWR bridge DUT port. The return loss is then measured with the cable or antenna-under-test on the SWR bridge DUT port.

This test should be used when there is a chance that a full frequency sweep of the band to be tested may cause interference. In this test, the chance of interference is greatly reduced by selecting an offset that sets a CW test frequency in between the assigned AMPS channels. For example, selecting an offset of 15 kHz places the test signal between adjacent AMPS channels and adjacent NAMPS channels.

See *TEST_44* for a return loss to VSWR conversion table and formula and a way to estimate the return loss of an antenna connected to the end of a feed line.

Analyzer Settings

There are no relevant Analyzer settings made during this test.

Parameters Used

- GN lev for VSWR and cable loss tests (dBm)

Specifications Used

- GN VSWR for discrete return loss (dB)

TEST_46 - GN Cable Fault

Note

Test Signal Can Cause Interference

This test radiates a test signal when it is used to test cables with antennas attached to them. Verify that the signal used for the test cannot result in interference to another antenna. The software reduces the signal generator level except when it is needed to actually perform the measurement.

Frequencies outside the cellular band will be swept. The frequency range used for this test depends on the cable length value you enter. For example, the frequency range of 10 MHz to approximately 1000 MHz is used for a 21 meter cable, 10 MHz to approximately 500 MHz for a 42 meter cable and so on.

This test displays the relative mismatch of a transmission line as a function of the distance down the line. A frequency-swept signal from the DUPLEX OUT port is applied through a resistive power divider to the cable under test. Signals reflected from faults in the cable are combined with the DUPLEX OUT signal in the power divider and applied to the ANT IN port. The changing interference of the forward and reflected signals, over the swept frequency band, contains information about the distance to one or more faults. The software uses a Fast Fourier Transform (FFT) to convert the frequency domain into the distance domain. The distance displayed on the Test Set CRT is the physical distance to the fault with correction for the velocity factor of the cable.

Cable Fault Performance

Measurements of the cable fault location can typically be made up to 1,000 feet on low loss cables and 300 feet on higher loss cables. Resolution of the fault location is approximately 0.4 feet for cable lengths up to 100 feet and then linearly increases to 4 feet for a 1000 foot cable.

Typical accuracy is approximately $\pm$ 1 foot for a fault located up to 100 feet away. The typical accuracy increases linearly to $\pm$ 10 feet for faults located 1,000 feet away.

Selecting Cable Type

When this test is run, a screen will appear which will prompt you for the following information:

- Cable length
- Cable length units:
  - Pressing the knob will toggle the selection between feet and meters.
- Cable class
  - Pressing the knob will toggle the selection between Heliax, RG, and Velocity
- The next prompt varies depending on the selection for Cable class:
  - If Velocity is selected, you will be prompted to enter the cable velocity propagation constant. This must be a value between 0 and 1.
  - If RG is selected, you will be prompted to enter the cable type with the example [RG 58/U = 58]. You must enter a value between 0 and 9999.
  - If Heliax is selected, you will be prompted to enter the cable type. A list will appear with choices of foam, air, and flex of varying thickness. Push the knob to select the desired cable type.
- Select `Begin Test` when all the appropriate entries have been made.

Note

Velocity Factors

Cables that use polyethylene dielectric typically have a propagation velocity of 0.66, cables that use a teflon dielectric typically have a propagation velocity of 0.70.

Entering Cable Length

The greatest accuracy is obtained when you enter a cable length slightly greater than the actual cable length, considering length uncertainty. If you are not sure of the cable length, enter a value 1.5 times the estimated length. Depending on the return loss of the antenna or device at the end of the cable, you may see a high relative mismatch displayed at the actual length of the cable.

Interpreting Cable Fault Location Results

Distance to the cable fault is accurately quantified when you select the USER `Disp data` field. The relative mismatch levels and distance at which the mismatch occurs is displayed.

Numeric data for the six largest values of data from the graph is listed. Each data point is shown on a scale from 0 to 1. The scaling does not have an absolute significance, rather, the value only indicates the relative likelihood of a fault. Values less than 0.1 are typically due to noise.

The largest relative mismatch is most likely the location of a cable fault. Other numeric data points, particularly if they are further down the line from a point of high relative mismatch, can be ignored. Data points on the fringe of a point of high relative mismatch are usually attributable to the single fault.

Analyzer Settings

There are no relevant Analyzer settings made during this test.

Parameters Used

There are no parameters used in this test.

Specifications Used

There are no specifications used in this test.

TEST_47 - GN Measure Cable Loss

This test measures the loss of a cable or device by sweeping it over the specified frequency range. The user is prompted to enter the frequency range over which the cable is to be swept.

This test requires two 6 dB pads. The pads are put on the antenna and duplex ports on the Test Set to improve the mismatch of the ports. A reference level is obtained by connecting a short calibration cable between the pads on the Duplex and Antenna ports. Next, the test cable is added between the test cable and one of the pads, and a measurement is made of the addition loss from the reference level. The trace of the cable loss over the frequency range swept is displayed. The average loss is also displayed on the screen.

To view the trace real time at the end of the test

- Press (CANCEL)
- Press (TESTS)
- Position the cursor to SPEC ANL on the `To Screen` menu and select it

Analyzer Settings

There are no relevant Analyzer settings made during this test.

Parameters Used

- GN lev for VSWR and cable loss tests

Specifications Used

- none

Parameter Descriptions

Parameters are used to define the conditions under which a test will run. You may edit the parameters to change the default values, to meet your specific testing needs and conditions. Parameters may be used in one or more tests.

For information on editing parameters, see *Customizing Testing* in chapter 3.

The list of parameters is arranged alphabetically. The first few letters in the title of each parameter indicate what the parameter refers to:

`GN` - General

`RX` - Receiver

`RX1` - Receiver A

`RX2` - Receiver B

`TX` - Transmitter

`ZZZZ` - Test/demo mode selection

GN Channel [Single=0 Edit Freq=1 LCR=2]

This parameter determines how the test channel information is input to the software.

If the user selects 0=`Single`, the channel number will be read from the value entered in the `RCU/CRCU Configuration, Setup, and Testing Screen`, which appears at the start of the test procedure.

If the user selects 1=`Edit Freq`, the channel numbers will be read from the values entered into the TESTS `Edit Frequency` Screen. The `RCU/CRCU Configuration, Setup, and Testing Screen` will appear between the testing of each channel so that the other appropriate fields and connections may be changed.

If the user selects 2=`LCR` (Locating Receiver), the channel numbers will be read from the values entered into the TESTS `Edit Frequency` Screen, and the testing will run continuously through all the channels entered.

GN level for VSWR and cable loss tests [dBm)

Enter the RF source duplex out level for the VSWR and Cable Loss tests.

GN make adjust audio only [0=no 1=yes]

If a particular measurement on the base station can be adjusted, this parameter allows the user to choose to make all adjustments by setting 0=`no`, or only audio in, audio out, and TX power adjustments by setting 1=`yes`. The audio adjustments are line/audio input and line/audio output. On the RCU this is R58 and R43, and on the CRCU they are Front Panel Audio In and Out. The parameter `GN make adjust` determines when or if the adjustments are performed.

GN make adjust [0=no 1=fail 2=always]

If a particular measurement on the base station can be adjusted, this parameter sets the adjustment conditions:

- 0=never: no adjustments are made.
- 1=on fail: the adjustment is only done if the measurement fails.
- 2=always: the adjustment is always done.

When an adjustment is performed, a meter is displayed to allow for adjustment.

RX audio frequency response step size (kHz)

This value entered into this parameter is used as a frequency step when the frequency response of the audio pass-band is measured. The two endpoints, 400 Hz and 2.5 kHz, are always measured.

RX audio out CRCU LINE OUTPUT LEVEL (LOL) (dBm)

This parameter is used when the RCU selected is Compact RCU in the `RCU/CRCU Configuration, Setup and Testing` Screen. This screen appears at the beginning of the test procedure each time it is run. This parameter contains the expected level at the receiver line/audio output when an RF signal at standard CRCU test level deviation is applied to an RX input, or an audio signal is applied to the test bus input or the line/audio input. The line output level is determined by the manufacturer or from your system audio levels.

RX audio out RCU OUTPUT TEST LEVEL (OTL) (dBm)

This parameter is used when the RCU selected is Extended Freq or Non Extended Freq, in the `RCU/CRCU Configuration, Setup and Testing` Screen. This screen appears at the beginning of the test procedure each time it is run. The expected level at the receiver line/audio output when an RF signal is applied to an RX input, or an audio signal is applied to the test bus input or the line/audio input. The OUTPUT TEST LEVEL is determined by the manufacturer or from the test level plan.

RX audio test input lev for CRCU std dev (dBm)

This parameter is used when the RCU selected is Compact RCU in the `RCU/CRCU Configuration, Setup and Testing` Screen. This screen appears at the beginning of the test procedure each time it is run. This value entered into this parameter is used to set the level of the audio generator signal that is applied to the test bus input.

The optimum test bus input level may depend on your system audio and deviation levels. The correct test bus level for an RCU with the standard TX deviation of 6.1 kHz is −1.5 dBm. If your system deviation levels are different, see *Testing Philosophy* earlier in this chapter. On some base stations, -1.5 dBm may be too low to result in the proper adjustment of TX limiting. When using this level, R5 - TX gain may be adjusted to a high setting, causing the subsequent adjustment of R136, mod limiting, to be impossible. R136 needs to be adjusted so the specification for deviation limiting is reached. By increasing the test bus input level, the internal reference level used during loopback tests is increased, R5 is adjusted lower, and R136 doesn't have to be set as low to achieve the specified limiting deviation. Setting this parameter to -.5 dBm allows good adjustment at 10.8 kHz limiting deviation.

RX audio test input lev for RCU std dev (dBm)

This parameter is used when the RCU selected is Extended Freq or Non Extended Freq in the `RCU/CRCU Configuration, Setup and Testing` Screen. This screen appears at the beginning of the test procedure each time it is run. The optimum test bus input level may depend on your system audio and deviation levels. The correct test bus level for a CRCU with the standard TX deviation of 2.9 kHz is −17.5 dBm. If you are using different system deviaitons, see *Testing Philosophy* earlier in this chapter.

RX audio/line output impedance (ohms)

This value in this parameter is the terminating impedance at the receiver line output. If the GE RCU base station is set to 600 ohms, enter 600 ohms. This parameter is used by the software when calculations are performed to determine audio power levels.

RX RF level for SAT and ST detection (dBm)

This parameter sets the signal generator levels that are applied to the voice receiver during SAT and Signaling Tone tests. Some RCU maintenance procedures specify this value at -116 dBm. -113 dBm is a better value to use.

RX RF level for SINAD (dBm)

This parameter sets the level that is applied to the RCU during SINAD tests. It is the desired level at the RCU. The parameters `RX1 (or RX2) path loss` are used together with this parameter to determine the signal generator output level.

RX RSSI check adj level only [0=no 1=yes]

Set this parameter to 1=`yes` if you only want to check RSSI at one level. The level will be the RF level specified in the parameter `RX RSSI RF level for adj`. Selecting 0=`no` will cause the adjustment level to be checked first followed by RSSI RF levels from −110 to −30 dBm.

RX RSSI offset

This parameter allows for an offset to be set in the reported RSSI from the RCU. For example, if a −90 dBm RF level is applied to the RCU receiver input and you want the RCU to report −85 dBm you would add an offset of +5 dBm. Setting an offset will effect RSSI linearity specification limits. Offsets cannot be set greater than +/− 15 dBm.

RX RSSI RF level for adj [-30 to -110] (dBm)

This parameter is used to set the level of the RF signal applied to an RX input during the adjustment of RSSI level.

RX SAT and ST test @ extremes [0=no 1=yes]

This parameter is used to test SAT and ST under extended test conditions.

See the description of TEST_20 *RX1 SAT detection*, TEST_22 *RX1 ST Detection*, and TEST_24 *RX1 SAT and ST falsing*.

RX standard CRCU test level deviation (kHz)

This parameter is used when the RCU selected is Compact RCU in the `RCU/CRCU Configuration, Setup and Testing` Screen. This screen appears at the beginning of the test procedure each time it is run. This parameter sets the FM deviation used when measuring the RX audio frequency response and the RX audio output levels. The application of a signal with an FM deviation equal to the RX standard test level deviation should result in a line/audio output level equal to the RX audio LINE OUTPUT LEVEL (LOL).

RX standard RCU test level deviation (kHz)

This parameter is used when the RCU selected is Extended Freq or Non Extended Freq in the `RCU/CRCU Configuration, Setup and Testing` Screen. This screen appears at the beginning of the test procedure each time it is run. See the above parameter description for the details of this parameter. (Replace LINE OUTPUT LEVEL with OUTPUT TEST LEVEL (OTL)).

RX1 audio lev adj with R43 or R132 [0=no 1=yes]

The software provides for the adjustment of the RX1 gain or the line/audio output for audio level in TEST_13 *RX1 audio level*. If you adjust the line/audio levels for RX1 audio which are R43 for RCU and R132 for CRCU, the front panel AUDIO OUT for the CRCU, set this parameter to 1=`yes`. See *Alignment Approaches* earlier in this chapter.

RX1 path loss (dB)

This parameter is used to correct the signal generator output level so the RF level applied to the RCU is close to the value specified in the relevant RF level parameter. Normally this parameter covers the loss of cables, but may include the loss of a splitter used to provide simultaneous connection to the RX1 and RX2 ports.

See *Path Loss Calibration* in chapter 2 for the method of measurement for this and the next parameter.

RX2 path loss (dB)

See RX path loss to antenna 1.

TX audio frequency response step size (kHz)

This parameter sets the value of the audio frequency step that is used as the frequency response of the audio pass-band is measured. The two endpoints, 300 Hz and 2.5 kHz, are always measured.

TX audio in CRCU LINE INPUT LEVEL (LIL) (dBm)

This parameter is used when the RCU selected is Compact RCU in the RCU/CRCU Configuration, Setup and Testing Screen. This screen appears at the beginning of the test procedure each time it is run. A standard audio level applied to the line/audio input. This level is used when testing the RF and audio sections of the transmitter and loopback circuits. A given level of transmitter signal deviation will result when the LINE INPUT LEVEL (LIL) is applied to the line/audio input. The LINE INPUT LEVEL (LIL) is determined by the manufacturer or from your system audio levels.

TX audio input RCU INPUT TEST LEVEL (ITL) (dBm)

This parameter is used when the RCU selected is Extended Freq or Non Extended Freq in the RCU/CRCU Configuration, Setup and Testing Screen. This screen appears at the beginning of the test procedure each time it is run. See the above parameter description for the details of this parameter. (Replace LINE INPUT LEVEL with INPUT TEST LEVEL).

TX audio/line input impedance (ohms)

The nominal load impedance of the TX line/audio input. This parameter is used when calculating the voltage that corresponds to a power level to be applied to the line/audio input.

TX limit aud 25 dB above ITL [0=no 1=yes]

This parameter determines the way that audio overdrive occurs during the measurement of TX voice deviation while limiting.

If this parameter is set to 1=**yes**, an audio level 25 dB above the INPUT TEST LEVEL (RCU) or LINE INPUT LEVEL (CRCU) is applied to the line/audio input. This method is only recommended for standard TX deviations around 6.1 kHz.

If this parameter is set to 0=**no**, the line/audio input level is first set 20 dB above the level required to obtain the deviation set in the parameter **TX limiting reference deviation**. In this case, the software will verify that limiting has actually occurred by checking the distortion. If the distortion indicates that limiting has not begun, the line/audio input level will be gradually increased until limiting starts.

TX limit prompt user adj aud [0=no 1=yes]

This parameter is used in TEST_05 - TX voice deviation limiting and TEST_11 - TX voice dev & limiting by audio LB, to determine if an adjustment prompt is displayed. During these Tests, the prompt asks that initial settings be made to R58 (RCU) or R102 (CRCU), line input, and R136 (RCU), modulation limiting. These initial adjustments may be needed to maximize the gain of the TX audio path prior to making adjustments. If you wish to bypass this prompt, set this parameter to 0=no .

TX limiting reference deviation (kHz)

Depending on the value in the parameter `TX limit aud 25 dB above ITL`, this parameter may be used to determine the TX line input level to be applied when measuring the TX audio limiting peak deviation. If the parameter `TX limit aud 25 dB above ITL` is set to `0=No`, the software will set the TX line input level 20 dB above the level that results in the deviation entered into this parameter.

For example, if this parameter is set to `8` kHz, and the parameter `TX limit aud 25 dB above ITL` is set to `0=No`, the software will set the line/audio input level to produce 8 kHz deviation. The line/audio input level will then be increased a factor of ten (20 dB) above this level and the limiting deviation will be measured.

TX limiting w/ compandor on [0=no 1=yes]

This parameter determines if the compandor will be enabled or disabled during TX limiting tests.

It is recommended that the compander be turned off to minimize the effect of the TX limiting adjustment on the TX audio level adjustment.

TX path loss (dB)

This parameter covers the loss of the cable used for connection between the RCU and the Test Set RF IN/OUT connector. It is used to determine the power at the high power TX output connector. See *Path Loss Calibration* in chapter 2.

TX power high level 0 (Watts)

This is the reference power level for power level 0 in the RCU or CRCU. Set this parameter for the required power for the site you are testing.

This parameter is used with RCUs with a single power level PA, RCUs with dynamic power PAs, and CRCUs with PA.

TX power high level 1 (Watts)

see TX power high level 0 description

This parameter is used only with RCUs with dynamic power, and CRCU with PA.

TX power high level 2 (Watts)

see TX power high level 0 description

This parameter is used only with RCUs with dynamic power, and CRCU with PA.

TX power high level 3 (Watts)

see TX power high level 0 description

This parameter is used only with RCUs with dynamic power, and CRCU with PA.

TX power high level 4 (Watts)

see TX power high level 0 description

This parameter is used only with CRCUs with an external PA.

TX power high level 5 (Watts)

see TX power high level 0 description

This parameter is used only with CRCUs with an external PA.

TX power high level 6 (Watts)

see TX power high level 0 description

This parameter is used only with CRCUs with an external PA.

TX power high level 7 (Watts)

see TX power high level 0 description

This parameter is used only with CRCUs with an external PA.

TX power low level 0 (Watts)

This parameter is used only with CRCUs with no external PA.

TX power low level 1 (Watts)

see TX power low level 0 description

This parameter is used only with CRCUs with no external PA.

TX power low level 2 (Watts)

see TX power low level 0 description

This parameter is used only with CRCUs with no external PA.

TX power low level 3 (Watts)

see TX power low level 0 description

This parameter is used only with CRCUs with no external PA.

TX power low level 4 (Watts)

see TX power low level 0 description

This parameter is used only with CRCUs with no external PA.

TX power low level 5 (Watts)

see TX power low level 0 description

This parameter is used only with CRCUs with no external PA.

TX power low level 6 (Watts)

see TX power low level 0 description

This parameter is used only with CRCUs with no external PA.

TX power low level 7 (Watts)

see TX power low level 0 description

This parameter is used only with CRCUs with no external PA.

TX power, test down to power level (0-7)

If the transmitter is capable of dynamic power stepping, TEST_01 *TX RF power level* will check down to the power level specified by this parameter. Use power levels 0-3 for testing an RCU, or 0-7 for testing a CRCU.

TX voice deviation adj with R58 or R102 [0=no 1=yes]

This parameter determines if the software prompts for the adjustment of R58 (RCU) or R102 (CRCU), line/audio input or the transmitter gain adjustment, when performing voice deviation adjustments. For example, in TEST_06 - `TX voice deviation (line input level)`, adjustment can be made to the transmitter gain, or to R58 (RCU) or R102 (CRCU), the line input control. This parameter determines which is displayed.

When testing an RCU, this parameter is not used in TEST_11 -`TX voice deviation & limiting by audio LB (loopback)`. In TEST_11, a prompt for the adjustment of R58 or R102 is displayed because R58 or R102 is set to mid-range at the start of the Test, and its correct setting must be re-established. See *Alignment Approaches* earlier in this chapter.

ZZZZ Test Mode [0=normal 1=demo]

This parameter is used to set up a demo mode. When this parameter is set to 1= demo , the software will bypass communication with the base station, allowing the program to be demonstrated without the base station. This mode is useful if you are working in a training or practice situation without a base station attached to the Test Set.

Specification Descriptions

Specifications are used to define the pass/fail limits for specific measurements. You may edit the specifications to change the default values to meet your specific testing requirements.

All specifications have lower and upper limits that can be entered. The column labeled `Check` on the TESTS (`Edit Specifications`) screen specifies whether the lower limit, the upper limit, or both of the limits are used when measurements are compared to specifications. Some of the default specifications provided in the software have only one of the limits chosen. If you enter the other limit, be sure to change the `Check` column to `Both`.

Specifications can be secured. See *Procedures: Securing a Procedure* in chapter 5.

For information on editing specifications, see *Customizing Testing* in chapter 3.

The list of specifications is arranged alphabetically. The first few capital letters in the title of each specification indicate what the specification refers to:

The first two capital letters in the title of each specification indicate what the specification pertains to:

GN=General

RT=Receiver and Transmitter

RX=Receiver

TX=Transmitter

Specifications can be secured. See *Securing a Procedure* in chapter 5.

GN VSWR for discrete return loss (dB)

This is the minimum return loss that is acceptable for discrete return loss.

GN VSWR for swept return loss (dB)

This is the minimum return loss that is acceptable for swept return loss.

RX audio distortion (dB)

The maximum acceptable distortion of a 1 kHz rate sine wave after it is output from the receiver.

RX audio hum and noise (dB)

This specification sets the acceptable ratio of the level of a 1 kHz sine wave at the line/audio output to the level of the noise that is present when the receiver RF input signal is not modulated.

RX audio level balance error (dB)

This specification determines the acceptable difference in the line/audio output level when a modulated signal is applied to the RX1 input and then the RX2 input. It is used when TEST_13 -`RX1 audio level` precedes TEST_14 -`RX2 audio level`.

RX audio level err from OTL or LOL

This specification determines the acceptable error in the level at the line/audio output when a modulated signal is applied to an RX input. The modulation level is determined by the value entered into the parameter(s) `RX standard CRCU test level deviation` or `RX standard RCU test level deviation`.

The expected line/audio output level is entered into the parameter(s) `RX audio out CRCU OUTPUT TEST LEVEL (LOL)` or `RX audio out RCU OUTPUT TEST LEVEL (OTL)`. This specification is used in TEST_13 - *RX1 audio level* and TEST_14 - *RX2 audio level*.

RX audio loopback err for CRCU alignment

This specification determines the acceptable error in the level at the line/audio output when a given level is applied to the line/audio input. This specification is only used for the loopback portion of the TEST_11 *TX voice dev & limiting by audio LB* for the CRCU. The level applied to the line/audio input is −20 dBm if you select alignment or the value entered into the parameter `TX audio in CRCU LINE INPUT (LIL)`.

RX audio loopback err from OTL or LOL (dB)

This specification determines the acceptable error in the level at the line/audio output when a given level is applied to the line/audio input. The level applied to the line/audio input is set by the value entered into the parameter(s) `TX audio in CRCU LINE INPUT LEVEL (LIL)` or `TX audio input RCU INPUT TEST LEVEL (ITL)`.

The expected line/audio output level is entered into the parameter(s) `RX audio out CRCU OUTPUT TEST LEVEL (LOL)` or `RX audio out RCU OUTPUT TEST LEVEL (OTL)`. This specification is used in TEST_13 - *RX1 audio level* and TEST_14 - *RX2 audio level*.

RX audio response err from -6 dB/oct (dB)

The level variation of the audio output compared to the expected response. The frequency response should result in an output level reducing 6 dB when the frequency is doubled. The deviation in dB from this ideal response is specified.

RX audio/line output err from OTL or LOL (dB)

The specification of the error in the level at the line/audio output when a level is applied to the test bus input. The level applied to the test bus input is set by the value entered into the parameters `RX audio test input lev for CRCU std dev` or `RX audio test input lev for RCU std dev`.

The expected line/audio output level is entered into the parameter(s) `RX audio out CRCU OUTPUT TEST LEVEL (LOL)` or `RX audio out RCU OUTPUT TEST LEVEL (OTL)`. This specification is used in TEST_13 - *RX1 audio level* and TEST_14 - *RX2 audio level*.

RX expander resp when dev reduced 10 dB (dB)

The expander increases the output level 2 dB for every 1 dB input level increase. This specification sets the acceptable deviation from this characteristic, when the deviation is set 10 dB below a reference deviation.

RX RSSI reporting err @ −40 dBm CRCU adj (dB)

This specification sets the limits of the error on the reported level of RSSI, when the −40 dBm level is applied to the RX input of the receiver. This specification is only used during the adjustment portion of the CRCU TEST_18 (19) *RX1 (2) signal strength indicator (RSSI)*

RX RSSI reporting error @ -30 dBm (dB)

This specification sets the acceptable deviation of the reported level of the Received Signal Strength Indicator, when -30 dBm is applied to an RX input of the receiver. It is used in TEST_18 - `RX1 signal strength indicator (RSSI)` and TEST_19 - `RX2 signal strength indicator (RSSI)`.

RX RSSI reporting error @ -40 dBm (dB)

See `RX RSSI reporting error @-30 dBm`. Replace "-30 dBm" with "- 40 dBm".

RX RSSI reporting error @ -50 dBm (dB)

See `RX RSSI reporting error @-30 dBm`. Replace "-30 dBm" with "- 50 dBm".

RX RSSI reporting error @ -60 dBm (dB)

See RX RSSI reporting error @-30 dBm. Replace "-30 dBm" with "- 60 dBm".

RX RSSI reporting error @ -70 dBm (dB)

See RX RSSI reporting error @-30 dBm. Replace "-30 dBm" with "- 70 dBm".

RX RSSI reporting error @ -80 dBm (dB)

See RX RSSI reporting error @-30 dBm. Replace "-30 dBm" with "- 80 dBm".

RX RSSI reporting error @ -90 dBm (dB)

See RX RSSI reporting error @-30 dBm. Replace "-30 dBm" with "- 90 dBm".

RX RSSI reporting error @ -100 dBm (dB)

See `RX RSSI reporting error @-30 dBm`. Replace "-30 dBm" with "- 100 dBm".

RX RSSI reporting error @ -110 dBm (dB)

See `RX RSSI reporting error @-30 dBm`. Replace "-30 dBm" with "- 110 dBm".

RX SAT frequency adjustment level

This specification sets the voltage limits for the SAT frequency adjustment in TEST_33 *RX SAT and ST alignment*.

RX SINAD

If the measured SINAD is greater than the number entered into the lower limit of this specification, then an RX sensitivity test will pass. For example, if the lower limit of this specification is set to 12 dB, a sensitivity test will pass if the measured SINAD is greater than 12 dB. The RF level applied to the receiver is determined by a parameter. See the parameter `RX RF level for SINAD` earlier in this chapter.

RX ST adjustment level (Vp-p)

This specification sets the voltage limits for the ST level adjustment in TEST_33 *RX SAT and ST alignment*.

RX ST frequency adjustment level (Vp-p)

This specification sets the voltage limits for the ST frequency in TEST_33 *RX SAT and ST alignment*.

TX audio distortion (percent)

The specification of the distortion of the transmitter modulation at a 1 kHz rate.

TX audio response err from 6 dB/oct (dB)

The level variation of the modulation on the transmitter signal compared to the expected response. The frequency response should result in a modulation level increasing 6 dB when the frequency is doubled. The deviation in dB from this ideal response is specified. The frequency response is checked from .3 to 2.5 kHz.

TX compandor resp when input red 20 dB (dB)

The TX compandor increases the output level 1 dB for every 2 dB input level increase. This specification sets the acceptable deviation from this characteristic, when the level is reduced 20 dB below a 2.9 kHz reference deviation.

TX data deviation (kHz)

The specification of the maximum and minimum peak frequency deviation resulting from a wideband data signal.

TX frequency error (ppm)

The specification of the difference between the measured and assigned transmitter frequencies, divided by the assigned transmitter frequency. The specification is in parts per million (ppm). An 880 Hz error is 1 ppm at 880 MHz.

TX hum and noise w/o C-message filter (dB)

This specification sets the minimum acceptable ratio of the level of a 1 kHz tone, modulated on the transmitter, to the level of the noise and other modulation when the transmitter is not modulated. The level of the noise and other modulation depends on the filter used. This specification is used when a 50 Hz HPF and a 15 kHz LPF are in the audio measurement path.

TX hum and noise with C-Message filter (dB)

This specification sets the minimum acceptable ratio of the level of a 1 kHz tone, modulated on the transmitter, to the level of the noise and other modulation when the transmitter is not modulated. The level of the noise and other modulation depends on the filter used. This specification is used when the C-Message filter is in the audio measurement path.

TX output power error at level 0 (Watts)

The specification of the minimum and maximum acceptable output power at level 0.

TX output power error at level 1 (Watts)

Same as above, at power level 1.

TX output power error at level 2 (Watts)

Same as above, at power level 2.

TX output power error at level 3 (Watts)

Same as above, at power level 3.

TX output power error at level 4 (Watts)

Same as above, at power level 4.

TX output power error at level 5 (Watts)

Same as above, at power level 5.

TX output power error at level 6 (Watts)

Same as above, at power level 6.

TX output power error at level 7 (Watts)

Same as above, at power level 7.

TX SAT deviation (kHz)

The maximum and minimum SAT tone FM deviation. Transmitter deviation resulting from the SAT tone is nominally 2 kHz.

TX SAT frequency error (Hz)

The error in the frequency of the 5970 Hz, 6000 Hz or 6030 Hz SAT tones.

TX voice deviation @ CRCU LINE INPUT LEVEL (kHz)

The maximum and minimum acceptable peak frequency deviation when the LINE INPUT LEVEL is applied to the line/audio input. The modulation signal is a 1.004 kHz tone. See parameter *TX audio in CRCU LINE INPUT LEVEL (LIL)* earlier in this chapter.

TX voice deviation @ RCU INPUT TEST LEVEL (kHz)

The maximum and minimum acceptable peak frequency deviation when the INPUT TEST LEVEL is applied to the line/audio input. The modulation signal is a 1.004 kHz tone. See parameter *TX audio input RCU INPUT TEST LEVEL (ITL)* earlier in this chapter.

TX voice deviation limiting (kHz)

The specification of the frequency deviation of the transmitter when a high level modulating signal is applied. TX limiting can be measured in two ways. See the parameters `TX limiting reference deviation`, and `TX limit aud 25 dB above ITL`.

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5

Reference (Alphabetical)

This chapter provides detailed descriptions of the features and functions of the HP 11807B software. Topics are arranged alphabetically for quick, easy reference.

Conventions Used

Special presentations of text in this manual reflect the appearance of the item being referred to.

Examples of these special presentations are:

(TESTS)	*A key on the Test Set.*
`Procedure:`	*Characters displayed on the CRT display.*
(K1) `Run Test`	*A USER key, in the key column next to the CRT.* `Run Test` *is displayed on the CRT.*
`0.000000`	*A field on the CRT where entries can be made.*

Titles of documentation are printed in italics.

The term **Test Set** refers to the HP 8921A.

In the steps in this manual the following words are used to describe cursor and entry actions:

- **select** refers to pressing the knob, after positioning the cursor in front of the appropriate field (`inverse video` area).
- **choose** means to position the cursor in front of an item in the `Choices:` or `To Screen` menu in the lower right corner of the CRT display, and then press the knob.
- **enter** means to use the numeric keypad, and the (ENTER) key or measurement units keys to make entries to fields. In some procedures, **enter** is used to describe the action of entering characters into a field.

Configuration

Configuration defines the equipment arrangement you use for data collection, RF switching, printing, and logging of base station messages.

Note

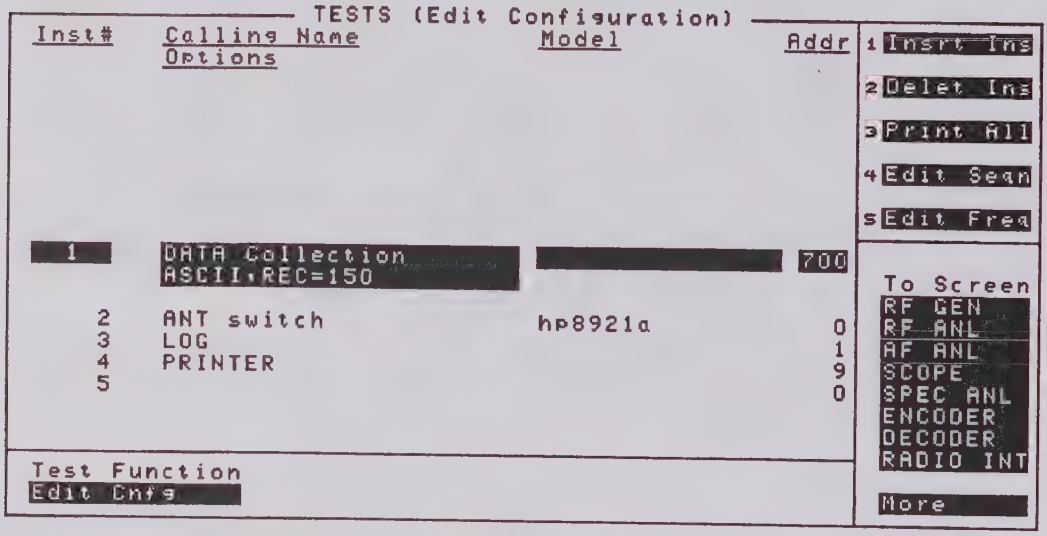
Confusion can arise with the term "Configuration". The Test Set has one or two CONFIGURE screens containing instrument setup conditions. One is accessed by pressing the CONFIG key. A second CONFIGURE screen, available in firmware shipped after October 1992, is accessed by selecting `More` from the `To Screen` choices. Some of the fields on the original CONFIGURE screen were moved to the second CONFIGURE screen.

There is also a screen called TESTS (`Edit Configuration`). This screen reflects the configuration of external equipment used during testing.

You will be entering some setup conditions into the CONFIGURE screens, and others into the table in the TESTS (`Edit Configuration`) screen. See the Test Set *User's Guide* and *Making Entries to a Test Set CONFIGURE screen*, in this manual, for details on the CONFIGURE screens.

In this manual the term **configuration** will be used to refer to entries made to the TESTS (`Edit Configuration`) screen, and to some entries made to a Test Set CONFIGURE screen.

Below is an example of possible entries to the TESTS (Edit Configuration) screen.



An Example TESTS (Edit Configuration) Screen

The entries shown in the example above set the Configuration to do the following:

- Collect data in an ASCII file using an HP-IB disk drive with address 700. 150 records are allocated.
- Use the Test Set Radio Interface Card to control an RF switch.
- Print test results to a serial printer.
- Log base station commands and messages to the CRT.

Messages and commands logged to the CRT can quickly scroll off the top of the display. They cannot be retrieved for subsequent display. If you need to view this information, you may have to log to a terminal or printer. If you are using a terminal or serial printer, enter 9 into the Addr field on the TESTS (Edit Configuration) screen.

Configuration Table

Tables 5-1 and 5-2 contain keywords that the HP 11807B Option 041 software will recognize. These keyword entries are made into the TESTS `(Edit Configuration)` screen.

Keywords are entries you make that are used by the software to provide information about the your particular disk drive, RF signal path switches, printer and/or use of logging.

Numbers and uppercase characters in the calling names, options, and model numbers are necessary. Lower case characters are optional.

The numbers in the **Inst#** column correspond to the list item numbers produced by the Test Set firmware. Entries are not made into this column. The order of the configuration items can be different from that shown in the tables. For example, `LOGging` can be entered into **Inst#** `1`.

See *Data Collection* for examples of entries you can make into the TESTS `(Edit Configuration)` screen.

Table 5-1. Data Collection, Printing, and Logging Configuration

Purpose	Inst#	Calling Name Options	Model	Addr	Description
HP-IB/Serial Data Collection see *Data Collection*	1	DATA Collection	don't care	7xx[1]	To HP-IB disk drive
	1	DATA Collection	don't care	1	To memory card
	Options:[2]	File types of ASCII, or BDAT, or (EXT),[3] or blank,[4] REC=xxxxx, (number of records)		7xx[1]	LIF format LIF format DOS file type DOS or HP-UX file type[4] Number of records
	1	DATA Collection	don't care	9	Serial to external computer (laptop)
Printing Test Results	2	PRINTER	don't care	7xx[1]	HP-IB Printer
	2	PRINTER	don't care	9	Printer, Serial
	Option:	LN=xx,[5]			xx lines before a form feed.
	Option:	START,[5]			Form feed at the start of each TEST in the sequence.
	Option:	END[5]			Form feed at the end of each TEST in the sequence.
Logging Commands/ Messages	3	LOGging	don't care	0	Logging off
	3	LOGging	don't care	1	Log to CRT
	3	LOGging	don't care	7xx[1]	HP-IB printer
	3	LOGging	don't care	9	Serial printer

1 xx = Last two digits of HP-IB address.

2 These options apply to disk drive and memory card data collection. They do not apply when collecting data with `Addr=9`.

3 A DOS file name extension. For example, the file name may be `CELL1.EXT`.

4 DOS is used if the disk format is DOS. HP-UX is used if the disk format is LIF.

5 Multiple options can be separated by a comma or space.

Table 5-2. RF Switch Configuration

Purpose	Inst#	Calling Name Options	Model	Addr	Description
ANT Switching	4	ANT switch	hp892xa	don't care (7xx not allowed)	Test Set Radio Interface
	Option:	LOW			Inverts polarity
	4	ANT switch	hp3488a	7xx[1]	
	4	ANT switch	SPLITter	don't care	user provided RF splitter between RX1 and RX2
Audio Switching	5	AUDIO switch	hp892xa	don't care (7xx not allowed)	Test Set Radio Interface
	Option:	LOW			Inverts polarity
	5	AUDIO switch	hp3488A	7xx[1]	HP 3488A Switch/Control Unit
	5	AUDIO switch	SPLITter	don't care	User provided splitter for TX audio input and test bus input

1 xx = Last two digits of HP-IB address.

To enter an item into TESTS (Edit Configuration):

1. Press [TESTS].
2. Position the cursor to the Test Function field and select it.
3. From the Choices menu, select Edit Cnfg.
4. Position the cursor to the field in the column labeled Inst# and select it.
5. Rotate the knob and select the desired Inst number (the next available field).
6. Press USER Insrt Ins or USER Delet Ins to insert or delete instruments.
7. Position the cursor to the Calling Name field and select it.
8. Using the characters available in the Choices Menu, enter the desired Calling Name. (See table 5-1)
   a. Use the [←] key to backspace.
   b. Press [CANCEL] to cancel entries and retain the old entry.
9. Choose Done from the list after the entry is made.
10. Repeat for Options, Model, or Addr fields as appropriate.

Default configuration entries have not been entered into the software. Messages may be displayed if you do not make necessary entries into the TESTS(Edit Configuration) screen.

The configuration remains in the Test Set's battery-backed-up memory. The Configuration used after power-up is the same one that was in the Test Set memory when the last power-down occurred.

The configuration is **not** saved with a Procedure to a memory card, RAM, or disk.

Making Entries to a Test Set CONFIGURE Screen

You can change the CRT intensity, beeper volume, and set the time and date of the Test Set real-time clock using the CONFIGURE screen. See the Test Set *User's Guide*.

Note **Two CONFIGURE Screens**

In versions of firmware shipped after October 1992, new CONFIGURE fields have been added. To accommodate all of the CONFIGURE fields, a second CONFIGURE screen has been added. You can access the second CONFIGURE screen by selecting `More` from the `To Screen` list in the lower right corner of the CRT display. Some of the fields on the original CONFIGURE screen were moved to the second CONFIGURE screen.

Depending on your use of the HP-IB and Serial port, you may have to use CONFIGURE to set up communication and protocol characteristics.

Serial Ports

There are two serial ports on the Test Set: Serial and Serial B.

The Serial port is available when you use the instrument manually. You can print screens or connect a terminal to remotely operate the Test Set. The Serial port can also be used to print test results or for data collection when tests are being run. You will have to make entries to a CONFIGURE screen if you use the Serial port.

The second serial port, the Serial B port, can only be controlled from IBASIC. It is used by the test software to send commands to, and receive messages from the base station. The setup conditions for this port cannot be entered manually. They are set automatically by the software.

Serial Port Configuration

Configuration for Printing Test Results

The characteristics of the Serial port are determined by settings on a Test Set CONFIGURE screen. The HP 11807B Option 041 software sets some of the fields on this screen. It does not set the following serial configuration items:

- `Serial Baud`
- `Parity`
- `Data Length`
- `Stop Length`
- `Rcv Pace`
- `Xmt Pace`

You will have to manually make entries into these fields. Determine the characteristics of your printer and enter them into a Test Set CONFIGURE screen. The entries will be retained after a power-down/ power-up cycle.

You will have to make entries into the TESTS `(Edit Configuration)` screen to use this serial port to print test results. See *Configuration* for the key words you must enter. See *Data Collection* for an example of how entries are made into the TESTS `(Edit Configuration)` screen.

When you print test results using the `PRINTER` key word on the TESTS `(Edit Configuration)` screen, the specification limits that are used for each of the tests are printed along with the measurement results. These limits are not displayed on the CRT while tests are running. Pass/fail indications are displayed on the CRT and printed.

To print results, you will have to select `Printer` as the `Output Destination` on the TESTS screen. See Printing later in this chapter.

Configuration for Data Collection

The characteristics of the Serial port, when used for data collection, are determined by settings on a Test Set CONFIGURE screen. The HP 11807B Option 041 software sets some of the fields on this screen. It does not set the following serial configuration items:

- Serial Baud
- Parity
- Data Length
- Stop Length
- Rcv Pace
- Xmt Pace

You will have to manually make entries into these fields. Determine the characteristics of your computer and enter them into a Test Set CONFIGURE screen. The entries will be retained after a power-down/ power-up cycle.

You will have to make entries into the TESTS (Edit Configuration) screen to use this serial port for data collection. See *Configuration* and *Data Collection* for the key words you must enter.

Configuration for Logging

The characteristics of the Serial port, when used for logging base station commands and messages, are determined by settings on a Test Set CONFIGURE screen. The HP 11807B Option 041 software sets some of the fields on this screen. It does not set the following serial configuration items:

- `Serial Baud`
- `Parity`
- `Data Length`
- `Stop Length`
- `Rcv Pace`
- `Xmt Pace`

You will have to manually make entries into these fields. Determine the characteristics of your computer or printer and enter them into a Test Set CONFIGURE screen. The entries will be retained after a power-down/ power-up cycle.

You will have to make entries into the TESTS (`Edit Configuration`) screen to use this serial port for logging. See *Configuration* for the key words you must enter.

Configuration for Terminal or PC Operation

It is preferable to enter long strings of characters into fields on the Test Set using a terminal. The characteristics of the Serial port, when used for instrument control from a terminal or terminal emulator, are determined by the following fields on a Test Set CONFIGURE screen.

- `Serial Baud`
- `Parity`
- `Data Length`
- `Stop Length`
- `Rcv Pace`
- `Xmt Pace`
- `Serial In` (must be set to `Inst`)
- `IBASIC Echo` (set to `On` if you want program output to be sent to your terminal)
- `Inst Echo` (set to `On` if you want to echo characters back to your terminal)

When the software starts, the last three fields in the list may be set opposite to what you want. If `PRINTER`, `DATA Collection`, or `LOGging` have been entered into the TESTS (`Edit Configuration`) screen and at least one of the `Addrs` is set to `9`, the test software will automatically set the fields as follows:

- `Serial In` to `IBASIC`
- `IBASIC Echo` to `Off`
- `Inst Echo` to `Off`

If you want to use the Serial Port for control or as a typing aid, and the configuration is set as described above, you will have to at least change the `Serial In` field. Do this as follows:

To CONFIGURE a terminal or PC:

1. Press (CANCEL) to pause the program.
2. Press (SHIFT) (CONFIG) to display the CONFIGURE screen
3. If the `Serial In` field is not on the screen, position the cursor to `More` in the `To Screen:` menu and select it.
4. Set `Serial In` to `Inst`
5. Set `IBASIC Echo` and `Inst Echo` as needed. See above.
6. Set the remaining configuration entries to match the settings of your terminal or PC program.
7. Make the necessary entries from the terminal.
8. Press (TESTS) to return to the TESTS screen.
9. Press USER `Continue` to continue the program.

If you start the program from the beginning by pressing USER `Run Test` or USER `Run`, the test software may reset the fields as described above.

See the Test Set *User's Guide* for lists of characters that will control the Test Set.

Configuration for Printing Screens

You can use a compatible serial printer to print what is currently displayed on the CRT. You will need to select `Serial` for the `Print To` selection.

You can enter a `Print Title` into a CONFIGURE screen. It will appear at the top of the printout after you press PRINT.

HP-IB Port Configuration

If you use an HP-IB printer, you do not have to make entries into a Test Set CONFIGURE screen. If the Mode on the CONFIGURE screen is not set to Control , the software will ask you if you want it to be set. Answer USER Yes . The setting will be retained after power-down.

If you want to use an HP-IB printer to print test results, you will have to enter a keyword and address into the TESTS (Edit Configuration) screen. See *Configuration*. You will also have to select Printer as the Output Destination in the TESTS Test Execution Conditions. See *Test Execution Conditions* in chapter 5.

When you print test results using the PRINTER key word on the TESTS (Edit Configuration) screen, the specification limits that are used for each of the tests are printed along with the measurement results. These limits are not displayed on the CRT while tests are running.

If you want to use an HP-IB printer to print what is currently displayed on the CRT, you will need to enter the following into the CONFIGURE screen:

- Mode - Control
- Prnt Adrs - The last two digits of the HP-IB address of your printer.
- Print To - HP-IB

You can enter a Print Title into a CONFIGURE screen. It will appear at the top of the printout after you press (SHIFT) (PRINT).

Copying Files

Files can be copied from one mass-storage device to another using IBASIC COPY commands. For example, to copy a file from an inserted memory card to the left drive of an external dual-disk drive with HP-IB address 700, press (TESTS). Position the cursor next to `Test Function` and select it. From the `Choices` Menu, select IBASIC. Position the cursor to the IBASIC command line and select it. Using the character list that appears in the `Choices` menu, enter the following command:

```
COPY "MY_TEST:INTERNAL" TO "MYFILE:,700,0"
```

You can copy a file from a memory card to an SRAM memory card by loading the program from the memory card into the Test Set, inserting an initialized SRAM memory card, and then using the IBASIC SAVE command. Enter the following:

```
SAVE "MY_TEST:INTERNAL"
```

You can list the names of the files stored in a memory card or disk catalog by using the IBASIC CAT command. To display a list of file names on a memory card, enter the following:

`CAT ":INTERNAL"` or `CAT`

If the mass storage is already defined to be the memory card, then `":INTERNAL"` is optional. If you are entering many characters into the IBASIC command line, you will want to connect a terminal to the Test Set. See *Serial Port Configuration*. You will also want to use a terminal if you have many files to list because file names displayed with the `CAT` IBASIC command scroll past the top of the Test Set's CRT display and cannot be scrolled down.

Detailed descriptions of IBASIC commands are contained in *HP 8920A Instrument BASIC* manual. See also: Data Collection Memory cards; initializing

Data Collection (Saving and Retrieving Test Results)

The software has the capability to save test results to a SRAM memory card, to a disk drive, or to a PC.

Collection to a Memory Card or Disk

You will have to make entries into the TESTS (`Edit Configuration`) screen to describe the type of data collection you are using.

To make TESTS (`Edit Configuration`) entries:

1. Press (TESTS)
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `Edit Cnfg`.
4. Position the cursor to the `Calling Name` field and select it.
5. Using the list of characters in the `Choices` menu, enter `DATA C` into the `Calling Name` next to `Inst# 1`. The entry will look like:

```
1    DATA C
```

6. Position cursor to `Addr` field and select.
7. Using the DATA keypad, enter a number into `Addr`, depending on the type of storage media you will be using (press (ENTER) when complete):

If you are using a memory card, enter `1` into the `Addr`:

```
1    DATA C                          1
```

If you are using a disk drive, enter the HP-IB disk address. For example, if the drive you are using is set to 700, then the display needs to look like:

```
1    DATA C                          700
```

Calling names can be entered in any order.

The test software supports data storage on Logical Interchange Format (LIF) and Disk Operating System (DOS) disk formats. Storage can be to any of the following file types:

- ASCII files under LIF
- BDAT files under LIF
- HP-UX files under LIF
- DOS files under DOS

You will be specifying the file type with the entry you make into the `Options` field immediately below `DATA C`. If no file type is entered, and the disk format is LIF, the software will select an HP-UX file type. If no file type is entered, and the disk format is DOS, the software will select a DOS file type. For example, if you are using a DOS file and you are not using an extension on the file name, the entry on the TESTS (`Edit Configuration`) screen will look like:

```
1   DATA C                                    700
```

If you are using an ASCII, BDAT or HP-UX file, you can specify the number of records allocated to the file. The DOS file is automatically updated as data is stored, so record allocation is not required. If you are using HP-UX files, you will have to enter `REC=` to establish a usable number of records. `REC=20480` sets the size to be the same as the default number of 256 byte records used for ASCII files (80 × 256). You can enter the `REC=` after the file type. For example, to use an ASCII file with 200 records of 256 bytes each, you will enter `ASCII REC=200` into the `Options` field. The display will appear as follows:

```
1    DATA C                                    700
     ASCII REC=200
```

The default number of records, used when no `REC=` entry is made, is 80.

Items in the `Options` field can be separated by a comma or a space.

See *Initializing a Disk* if using a new disk. See *Initializing a Memory Card* if using a new memory card. The file types under LIF can be used by the Test Set IBASIC controller and some HP workstations. The DOS format is required if you wish to use the disk with a PC.

Table 5-3.
Data Collection (Saving/Retrieving Tests) Configuration Summary

Inst#	Calling Name Options	Model	Addr	Description
1	DATA Collection	don't care	7xx[1]	To HP-IB disk drive
1	DATA Collection	don't care	1	To memory card
Options:[2]	File types of ASCII, or BDAT, or (EXT),[3] or blank,[4] REC=xxxxx, (number of records)	don't care	7xx[1]	LIF format LIF format DOS file type DOS or HP-UX file type[4] Number of records
1	DATA Collection	don't care	9	Serial to external computer (laptop)

1 xx = Last two digits of HP-IB address.

2 These options apply to disk drive and memory card data collection. They do not apply when collecting data with `Addr=9`.

3 A DOS file name extension. For example, the file name may be `CELL1.EXT`.

4 DOS is used if the disk format is DOS. HP-UX is used if the disk format is LIF.

Retrieving Data from a Memory Card

To retrieve the test results after they have been saved on an SRAM memory card, you will have to run an IBASIC program. A program to transfer data from a memory card to a terminal emulator is listed below. You can type the program lines into the IBASIC command line from a terminal emulator. See *Configuration for Terminal or PC Operation* in this chapter.

To enter the data retrieval program:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `IBASIC`.
4. Position the cursor to the IBASIC command field (large field in the upper part of the display) and select it. From the list of characters in the `Choices` field, enter the following IBASIC program statements and commands.
5. Enter `SCRATCH` to delete the previous IBASIC program. Be sure it's saved first.
6. Enter the following program:

```
10 DIM A$[120]                                  Sets the string length to
                                                120.
20 ASSIGN @File TO "RES:INTERNAL";FORMAT ON     Opens a path to the mem-
                                                ory card file called "RES"
                                                (for results).
30 ON ERROR GOTO 80                             Exits at end of file if an
                                                error is encountered.
40 LOOP                                         Extracts file contents.
50 ENTER @File;A$                               Transfers part of the file to
                                                the string.
60 OUTPUT 9;A$                                  The string is output at the
                                                Serial port.
70 END LOOP                                     Goes back to get more of
                                                the file.
80 END                                          End of the program.
```

7. Press (K1) Run to run the entered IBASIC program.

Note

Difference between `Run` and `Run Test`

The USER `Run` key, assigned as a default key on the TESTS `(IBASIC Controller)` screen, will start an IBASIC program that is resident in the Test Set's memory. The USER `Run Test` key, assigned as a default key on the TESTS screen, will load the program that is called from the `Procedure:` and `Location` entries on the TESTS screen.

Collection to a PC

Test results can be output through the serial port. A variety of devices can receive the data. An HP 95LX Palmtop, PC, laptop, or terminal can be used. A terminal emulator can log the test results to a file. Examples of terminal emulator programs are HP AdvanceLink and ProComm, a product of DataStorm Technologies, Inc.

For example: Configuring an IBM-Compatible PC with HP AdvanceLink for DOS

1. Load and run HP AdvanceLink on your PC.
2. Use the following tables to set the *Global Configuration*, *Terminal Configuration*, and *Remote Configuration* settings.

Global Configuration Settings

FIELD	SETTING
Keyboard	USASCII
Personality	HP
Language	English
Terminal Mode	Alphanumeric
Remote to	*enter PC's serial port #*
Printer I/F	None

FIELD	SETTING
Memory Size	32K
Plotter I/F	None
HP Mode	Yes
Video Type	*Select your display type*
Forms Path	*Enter path if used*
Screen Size	*Enter the size*

Terminal Configuration Settings

FIELD	SETTING	FIELD	SETTING
Terminal ID	2392A	Esc Xfer(N)	YES
Local Echo	OFF	ASCII 8 Bits	YES
CapsLock	OFF	FldSeparator	US
Start Col	01	BlkTerminator	RS
Bell	ON	ReturnDef	CR
XmitFnctn(A)	NO	Copy	Fields
SPOW(B)	NO	Type Ahead	NO
InhEolWrp(C)	NO	ROW Size	80
Line/Page(D)	LINE	Host Prmpt Char	D1
InhHndShk(G)	NO	Horiz. Scroll. Incr.	08
Inh DC2(H)	NO	Large [+] Key	+

Remote Configuration Settings

FIELD	SETTING	FIELD	SETTING
Baud Rate	4800	SR(CH)	LO
Parity/Data Bits	None/8	Recv Pace	None
Eng Ack	No	Xmit Pace	None
Asterisk	OFF	CS(CB)Xmit	NO
Chk Parity	NO		

To set up for data collection to a PC:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `Edit Cnfg`.
4. Position the cursor to the `Calling Name` field and select it.
5. Using the list of characters in the `Choices` menu, enter `DATA C` (next to `Inst# 1`):

   ```
   1   DATA C
   ```

6. Position the cursor to the `Addr` field and select it.
7. Using DATA keypad, enter `9` and press (ENTER):

   ```
   1   DATA C                                    9
   ```

Calling names can be entered in any order.

Configuration for Terminal or PC Operation

It is preferable to enter long strings of characters into fields using a terminal. The characteristics of the Serial port, when used for instrument control from a terminal or terminal emulator, are determined by settings on a Test Set CONFIGURE screen.

Set the following:

- `Serial In` to `Inst`
- `IBASIC Echo` to `On`
- `Inst Echo` to `On`

Set the remaining configuration entries to match the settings of your terminal or PC program.

Equivalent Front-Panel Control Characters

The following table lists the terminal/computer keystrokes that equate to front-panel controls. *Each equivalent character must be preceded by the* **Escape** *key.*

For example, to remotely access the **CONFIGURE** screen, you type Esc, C on your terminal/computer. (Be sure to use upper-case C for this example.)

Alternate sequences for 5 commonly-used functions are also available. Hold down the Ctrl (control) key and select the corresponding key for the desired function. (Example: Ctrl/H moves the cursor to the left one space.)

ENTER - ^J or ^M

CANCEL - ^C

BACKSPACE - ^H

KNOB_TURN_CW - ^R

KNOB_TURN_CCW - ^L

Equivalent Front-Panel Control Characters

Function	Equiv. ESC Char.
CANCEL	!
PERCENT MHZ_V	(
S_KHZ_MV	)
BACKSPACE	-
ENTER	.
RELEASE	0
K1	1
K2	2
K3	3
K4	4
K5	5
K1_PRIME	6
K2_PRIME	7
K3_PRIME	8
ASSIGN	9
KNOB_TURN_CCW	<
KNOB_TURN_CW	>
MSSG	A
HELP	B
CONFIG	C
HOLD	D
PRINT	E
ADRS	F

Function	Equiv. ESC Char.
SAVE	G
REF_SET	J
METER	K
AVG	L
LO_LIMIT	M
HI_LIMIT	N
E	R
F	S
B	U
C	V
D	W
A	X
EEX	Z
YES_ON_OFF	[
NO_PPM_W	]
RX	a
TX	b
DUPLEX	c
PREV	d
TESTS_MAIN	e
LOCAL	f
RECALL	g
MEAS_RESET	h

Function	Equiv. ESC Char.
PRESET	i
INCR_DIV_10	j
INCR_SET	k
INCR_TIMES_10	l
DOWN	m
UP	n
SEVEN	o
EIGHT	p
NINE	q
FOUR	r
FIVE	s
SIX	t
ONE	u
TWO	v
THREE	w
ZERO	x
POINT	y
PLUS_MINUS	z
OHM_PCT_DEL_DBUV	{
DB_GHZ_DBM	|
MS_HZ_UV	}

Initializing a Disk

If you are starting with a blank disk, you will have to initialize it to the format you have chosen. Disk drives require specific commands to perform initialization. The Test Set's IBASIC commands to initialize some disks are described here. You should verify that the drive you are using can be controlled by the Test Set and that you are initializing a disk using a drive or PC that has a compatible format.

To initialize a disk to LIF in an HP-IB disk drive:

1. Verify that the Test Set `Mode` on the CONFIGURE screen is set to `Control`:
   a. Press (TESTS).
   b. Position the cursor to the `Test Function` field and select it.
   c. From the `Choices` menu, select `Edit Confg`.
   d. From the `To Screen` menu, select `More`.
   e. From the `Choices` menu, select `I/O Confg`.

2. Enter the IBASIC command:

   a. Press [TESTS].

   b. Position the cursor to the `Test Function` field and select it.

   c. From the `Choices` menu, select `IBASIC`.

   d. Position the cursor to the IBASIC command field and select it.

   e. With the list of characters in the `Choices` menu, enter the following:

```
INITIALIZE ":,7xx,y"
```

   where:
   xx = the HP-IB address of the disk drive, and
   y = the unit number of the drive.

To initialize a disk to DOS in an HP-IB drive:

Follow the procedure for the LIF format, replacing the INITIALIZE statement with `INITIALIZE "DOS:,7xx,y"` .

Retrieving Data from a Disk

One way to retrieve the test results from a disk is to run an IBASIC program. A program to transfer data from a disk to a terminal emulator is given below. You can type it into the IBASIC command line from the terminal emulator.

Be sure your program is saved, because it will be deleted from programmable memory. The file name for this example is "RES". The disk address is 700, and the drive number is 0. The entire file name is `RES:,700,0`.

To enter the data retrieval program:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `IBASIC`.
4. Position the cursor to the IBASIC command field (large field in the upper part of the display) and select it. From the list of characters in the `Choices` field, enter the following IBASIC program statements and commands.
5. Enter `SCRATCH` to delete the previous IBASIC program. Be sure it's saved first.
6. Enter the following program:

```
10 DIM A$[120]                    Sets the string length to 120.
20 ASSIGN @File TO "RES:,700,0"   Opens a path to the file called
                                  "RES" (for results).
30 ON ERROR GOTO 80               Exits at end of file if an error is
                                  encountered.
40 LOOP                           Extracts file contents.
50 ENTER @File;A$                 Transfers part of the file to the
                                  string.
60 OUTPUT 9;A$                    The string is output at the Serial
                                  port.
70 END LOOP                       Goes back to get more of the file.
80 END                            End of the program.
```

7. Press [K1] Run to run the entered IBASIC program.

Frequency Table

The frequency table is used to enter and store channel numbers. The procedure (including the frequency table) may also be saved to an SRAM card for later use (see *Procedures* later in this chapter).

The `Test?` field is useful if you have saved all the shelf information to a frequency table and want to go back and test some (but not all) of the channels. By setting this field to `No` for the base stations you do not wish to test, you will retain the channel number information in the procedure, but not test the channel(s). Change this setting back to `Yes` when you desire to test the channel(s).

Note

There are three methods of getting channel information for testing. Parameter *GN Channel [0=Single 1=Edit Freq 2=LCR]* selects which method of channel definition is used.

Selecting 0=`Single` allows the user to input a channel number in the `Channel number` field that appears at the start of testing on the RCU/CRCU Configuration, Setup and Testing Screen. All tests in the test sequence will be run on this channel and then the test will stop. Next time the test is run, the channel in the `Channel number` field will need to be changed manually for the next base station you want to test. This method is useful if you just want to enter the channel number for each base station at the time you test it.

Selecting 1=`Edit Freq` inputs the first channel number contained in the `Edit Frequency` Screen into the `Channel number` field on the `RCU/CRCU Configuration, Setup, and Testing` screen. All tests in the test sequence will be run on this channel and then the software will return to the `RCU/CRCU Configuration ...` Screen. The `Channel number` field will now contain the next channel specified in the `Edit Frequency` Screen. The software will perform all the tests in the sequence and again return to the `RCU/CRCU Configuration ...` Screen. This will continue until the sequence of tests are run on all the channels specified in the `Edit Frequency` screen. This method is useful if you have the entire frequency plan for the cell site saved on the memory card and you want to test all the base stations in the site.

Selecting 2=LCR is used for Locating Receiver (LCR) testing. The first channel number contained in the Edit Frequency screen is placed into the Channel number field on the RCU/CRCU Configuration, Setup, and Testing screen. The test sequence is run on this channel number and continues to be repeated on each channel specified in the Edit Frequency screen. The RCU/CRCU Configuration, Setup, and Testing screen does not appear at the start of each new channel. For example, with this method you could test RSSI on your LCR across several channels without being prompted with each new frequency.

To edit a frequency table:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `Edit Freq`.
4. Position the cursor to the `Test?` field and select it.
5. Press the knob to toggle the underline to the desired response (`Yes` or `No`).
6. Position the cursor to the `RX Chan Info` field and select it.
7. Using the DATA keys, enter the channel number and select it.
8. Press (TESTS) to return to the Test Screen.

HP-IB Control Annunciators

The words, letters, and symbols at the top right corner of the CRT display indicate these conditions:

- R indicates remote operation from an external controller or IBASIC program in the Test Set. This letter will be displayed while the software is running.
- L indicates the Test Set is listening, and is ready to receive a manual or remote command.
- T indicates the Test Set is talking to another HP-IB device.
- S indicates a service request has been generated.
- C indicates the Test Set is currently an active controller. Control mode is set on a CONFIGURE screen. The Test Set must be a controller if HP-IB peripherals are to be controlled.
- * indicates an IBASIC program is running, or the IBASIC controller is executing a command.
- ? indicates an IBASIC program is waiting for a user response.
- - indicates that the IBASIC program is paused.
- SHIFT indicates that the [SHIFT] key was pressed, and that the next key entry will be shifted. (Press [SHIFT] again to clear).

Logging

Logging is used to monitor all the commands from the HP 8921A to the base station and all the messages returning from the base station. These commands and messages may be displayed on the CRT or output to a printer.

To enable the logging function:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `Edit Cnfg`.
4. Press (K1) `1 Insrt Ins`.
5. Position the cursor to the `Inst#` field and select it.
6. Rotate the knob to the first vacant `Calling Name` field and select it.
7. Position the cursor to the `Calling Name` field and select it.
8. Enter L O G into the Calling Name field by:
   a. rotating the knob and positioning the cursor beside L in the `Choices` field and selecting it.
   b. repeating for O and G.
   c. positioning the cursor to `Done` in the `Choices` field and selecting it.
9. Position the cursor to the `Addr` field and select it.

10. Choose output mode:
    a. For CRT: Press 1 on the DATA keypad and press [ENTER].
    b. For HP-IB printer: Press 70x on the DATA keypad and press [ENTER].
    c. For serial printer: Press 9 on the DATA keypad and press [ENTER].
11. Press [TESTS] to return to the TEST screen.

Note

Logging occurs rapidly on the screen. To stop for inspection, press [CANCEL]. To continue, press the User Key [K2]: `Continue`.

Memory Cards

Memory cards are inserted into the slot on the Test Set's front panel. The memory card is powered by the Test Set while it is inserted. Arrows printed on the memory card and the Test Set's front panel indicate the direction and orientation of card insertion.

Memory cards are used to store or retrieve the following:

- Cell Site software code
- An HP-supplied Procedure, containing:
  - A default TEST sequence
  - Default parameter values
  - Default specification values
  - Default frequency values
- A Library file
- Procedures you make, optimized for your application
- Data collection files
- Frequency Plans
- User defined keys

Two types of memory cards are available:

- Static Random Access Memory (SRAM)
- One-Time Programmable (OTP)

SRAM cards have read and write capability. Once programmed, OTP cards have read-only capability. The Cell Site Software is normally supplied on a One-Time Programmable memory card.

The software memory card can be removed after the program is loaded into the HP 8921A memory. The program will remain in memory after a power-down/power-up cycle, until a new program is loaded. Loading a new program will replace the existing program.

SRAM Memory Cards

A Static Random Access Memory (SRAM) Card can be used to store test results and procedures you make. The following parts can be used.

Table 5-4. SRAM Memory Card Part Numbers

Memory	Part Number
32 kilobytes	HP 85700A
128 kilobytes	HP 85702A
256 kilobytes	HP 85704A
512 kilobytes	HP 85705A

SRAM memory cards use a lithium battery (part number CR 2016 or HP part number 1420-0383). Programs and data will be retained for over one year if the memory card is stored at 25° C. The memory card is powered by the HP 8921A while it is inserted. Replace the battery while the memory card is inserted into a powered-up HP 8921A. To retain data and programs, it should be replaced annually. See the *HP 8921A User's Guide*. The write protect switch on an SRAM memory card will write protect the card when it is set toward the outside of the card.

Caution **Accidentally Erasing Software**

If your software is resident on an SRAM card, it is possible to delete it from the card. To prevent the loss of your program, check the write protect switch on the SRAM memory card and verify that the card is write protected. Leave the switch set toward the outside of the card except while you are writing to it.

Memory Card Storage Space

Procedures use 16 records each. A Library uses 22 records. A single library must be included on the card. A record is 256 bytes. Approximately 11 kilobytes of overhead is required on each card.

Use the following formula to estimate the storage space needed:

```
Storage Space(in kilobytes) =
              (Number of Procedures × 4.1) + 17
```

For example, if you are testing ten cell sites, you will need ten procedures, and 58 kilobytes of memory. The 128 kilobyte card is sufficient.

The storage space you need for data collection depends on the number of test results that are saved. You will need approximately 4 kilobytes per page of test results that you save. A page of test results is about 57 lines of CRT or printer output.

The storage space of smaller SRAM cards can be quickly used. If you are collecting large quantities of data, data collection using a PC or printer may be preferable.

Initializing a Memory Card

There are two ways to initialize a memory card. If you have a terminal emulator attached to the Test Set, you can type a command into the IBASIC command line. A second way to initialize a card is to run the ROM program RAM_MNG.

To initialize an SRAM memory card for use under the LIF format

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select IBASIC.
4. Position the cursor to the IBASIC command line and select it.
5. Using the list of characters under the `Choices` menu, enter the following IBASIC command:

```
INITIALIZE ":INTERNAL"
```

To run RAM_MNG

1. Press (TESTS).
2. Position the cursor to the `Location` field and select it.
3. From the `Choices` menu, select `ROM`.
4. Position the cursor to the `Procedure` field and select it.
5. From the `Choices` menu, select `RAM_MNG`.
6. Press (K1) `Run Test`.
7. Follow the displayed instructions.

Note

Loading RAM_MNG will delete any procedure or program in memory.

Retrieving Data from a Memory Card

To retrieve the test results after they have been saved on an SRAM memory card, you will have to run an IBASIC program. A program to transfer data from a memory card to a terminal emulator is listed below. You can type the program lines into the IBASIC command line from a terminal emulator. See *Configuration for Terminal or PC Operation* in this chapter.

To enter the data retrieval program:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `IBASIC`.
4. Position the cursor to the IBASIC command field (large field in the upper part of the display) and select it. From the list of characters in the `Choices` field, enter the following IBASIC program statements and commands.
5. Enter `SCRATCH` to delete the previous IBASIC program. Be sure it's saved first.
6. Enter the following program:

```
10 DIM A$[120]                              Sets the string length to 120.
20 ASSIGN @File TO "RES:INTERNAL";FORMAT ON Opens a path to the memory card file called "RES" (for results).
30 ON ERROR GOTO 80                         Exits at end of file if an error is encountered.
40 LOOP                                     Extracts file contents.
50 ENTER @File;A$                           Transfers part of the file to the string.
60 OUTPUT 9;A$                              The string is output at the Serial port.
70 END LOOP                                 Goes back to get more of the file.
80 END                                      End of the program.
```

7. Press (K1) Run to run the entered IBASIC program.

Note

Difference between `Run` and `Run Test`

The USER `Run` key, assigned as a default key on the TESTS (`IBASIC Controller`) screen, will start an IBASIC program that is resident in the Test Set's memory. The USER `Run Test` key, assigned as a default key on the TESTS screen, will load the program that is called from the `Procedure` and `Location` entries on the TESTS screen.

Parameters

Parameters are values you enter that optimize your use of the test software. Many of the parameters are determined by examining your test needs. Other parameters are determined by performing measurements to calibrate your system.

Default values are set into the software. Some of these values are derived from standard methods of measurement and some are derived from the cellular Base Station requirements. Load a Procedure and select the TESTS (`Edit Parameters`) screen to see the default values.

You should verify that parameters are properly set after you select the tests to be placed in your sequence.

Parameters remain in battery-backed-up memory until you select a Procedure to run. If you wish to prevent them from being lost when a new Procedure is selected, you will have to save them in a Procedure. See *Making a Procedure*.

To print the parameters list, see *Printing Test Screens*.

To edit a parameter value:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `Edit Parm`.
4. Position the cursor to the `Parm#` field and select it.
5. Rotate the knob to the desired parameter number and select it.
6. Position the cursor to the `Value` field and select it.
7. Enter the desired value using the DATA keypad and press (ENTER).
   a. Use the (←) key to backspace.
   b. Press (CANCEL) to cancel entries and retain the old value.
8. Press (TESTS) to return to the Test Screen.

Pausing or Stopping a TEST

To pause the program, press (CANCEL).

To stop the program, press (SHIFT) then (CANCEL). This performs an IBASIC RESET operation.

Note **Changing Settings while Paused**

If you make changes to instrument settings while the program is paused, subsequent operation may be unpredictable. Error messages may or may not be displayed.

To continue a paused program:

1. Press (TESTS).
2. Press (K1) `Continue`.

The test time is displayed when the test is completed. This time includes the time that the program is paused and the time that it is waiting for connection and inputs to be made. If you are testing through midnight, the test time will not display properly.

Do not press (RX) or (TX) to exit the program. Selecting the RX TEST or TX TEST screen causes signal paths internal to the Test Set to be modified.

Caution

If you exit the program by pressing (CANCEL), and then change specifications, parameters, or configuration, the new values may not be used by the software after you press USER `Continue`. Start the program over again to ensure that your changes are used.

Printing

You can print any of the following:

- Test results
- TESTS screens
  - "Edit Configuration"
  - "Edit Sequence"
  - "Edit Frequency"
  - "Edit Specifications"
  - "Edit Parameters"

How to Print (task list)

There are five basic steps to printing listed below. A detailed description of each of these steps is at the end of this section.

1. Check to see if your printer is supported by the HP 8921A (see *Supported Printers*).
2. Determine if your printer requires serial or HP-IB connection. Connect the printer to the appropriate port on the HP 8921A (see *Printer Connection*).
3. Configure the HP 8921A for your printer and its interface (see *Configuring the HP 8921A for Printing*).
4. Instruct the HP 8921A what to print (see *Printing Test Results*).

Supported Printers

The HP ThinkJet, HP QuietJet, HP DeskJet, and HP LaserJet printers are supported on the HP 8921A. If you do not have one of these printers, consult your printer's manual for the correct printer settings to emulate one of the supported printers.

Printer Connection

HP-IB Connection

An HP-IB printer can be connected to the Test Set's rear-panel HP-IB connector with an HP-IB cable.

Serial Connection

A serial printer can be attached to the Serial port. See figure 5-1. Use the following RJ-11 pins for this connection.

- RJ-11 Pin 2 - Test Set Receive data
- RJ-11 Pin 4 - Ground
- RJ-11 Pin 5 - Test Set Transmit data

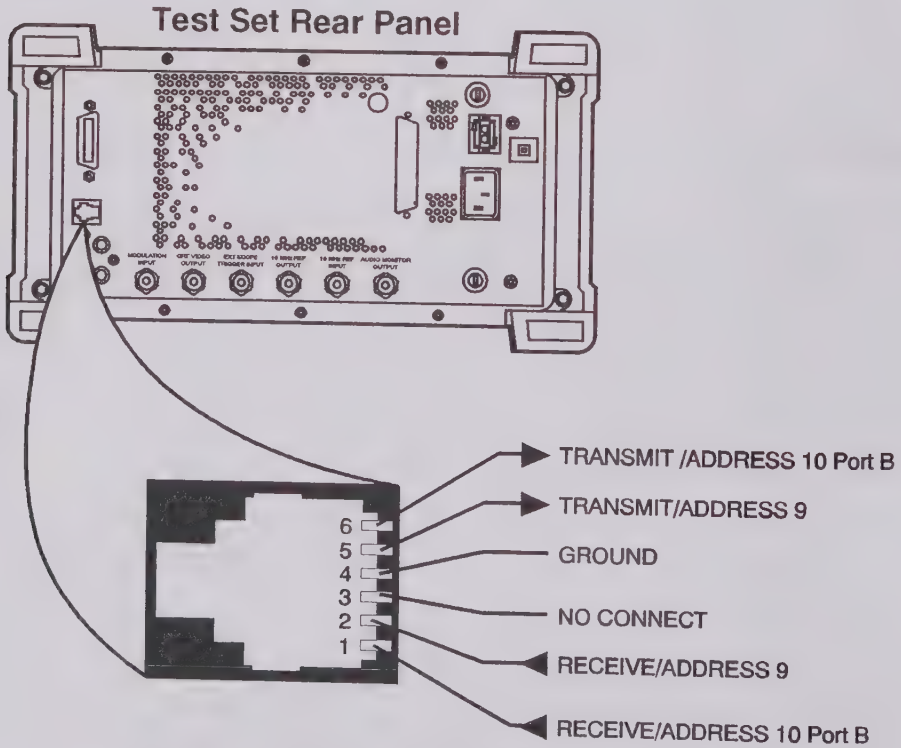


Figure 5-1. Test Set RJ-11 Serial Port Connections

Configuring the HP 8921A for Printing

To Use a Serial Printer

If using a serial printer, you cannot use the Serial port for other connections at the same time, such as Data Collection (saving test results). Serial port connections are shown earlier in this section.

1. Press (TESTS)
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `Edit Cnfg`.
4. Position the cursor to the `Inst#` field and select it.
5. Rotate the knob until an empty `Calling Name` field appears, and select it.
6. Position the cursor to the `Calling Name` field and select it.
7. Using the list of characters in the `Choices` menu, enter the word `Printer`. Select `Done` when complete.
8. Position the cursor to the `Model` field and select it (optional).
9. Using the DATA keypad, enter the Model # and press (ENTER).
10. Position the cursor to the `Addr` (address) field and select it.

11. Using the DATA keypad, enter `9` for serial printers and press (ENTER). This address will always be 9.
12. Position the cursor to the `Options` field (directly under `Calling Name`) and select it.
13. Using the list of characters from the `Choices` menu, the following commands may be entered. Separate the commands with commas (example; `LN=60,START,END`)
    a. **LN** equals the number of printed lines per page.
    b. **START** causes a form feed at the start of each printout.
    c. **END** causes a form feed at the end of each printout.
14. From the `To Screen` menu, select `More`.
15. From the `Choices` menu, select `IO CONFIG`.
16. Set the `Serial Baud` field and other serial communications fields listed under it to correspond to your printer's configuration.
17. Press (TESTS) to return to the TESTS screen.

To Use an HP-IB Printer

1. Press (TESTS)
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `Edit Cnfg`.
4. Position the cursor to the `Inst#` and select it.
5. Rotate knob until an empty `Calling Name` field appears, and select it.
6. Position the cursor to the `Calling Name` field and select it.
7. Using the list of characters in the `Choices` menu, enter the word `Printer`. Select `Done` when complete.
8. Position the cursor to the `Model` field and select it (optional).
9. Using the DATA keypad, enter the Model # and press (ENTER).
10. Position the cursor to the `Addr` (address) field and select it.
11. Using the DATA keypad, enter `70X` for HP-IB printers and press (ENTER). This address will always be 70X.
12. Position the cursor to the `Options` field (directly under `Calling Name`) and select it.
13. Using the list of characters from the `Choices` menu, the following commands may be entered. Separate the commands with commas (example; `LN=60,START,END`)
    a. **LN** equals the number of printed lines per page.
    b. **START** causes a form feed at the start of each printout.
    c. **END** causes a form feed at the end of each printout.
14. From the `To Screen` menu, select `More`.
15. From the `Choices` menu, select `IO CONFIG`.
16. Position the cursor to the `Mode` field and select it.
17. From the `Choices` menu, select `Control`.
18. Position the cursor to the `Print Adrs` field and select it.
19. Rotate the knob and select the HP-IB address of your printer.

20. Position the cursor to the `Print To` field. Pressing knob will toggle the underlined selection. Select to underline `HP-IB`.

21. Press (TESTS) to return to TESTS screen.

Printing Test Results

1. Make sure that your printer is properly connected and configured as explained earlier in this section.
2. Press (TESTS).
3. Position the cursor to the `Output Destination` field. Pressing knob will toggle the underlined selection. Select to underline `Printer`.
4. Position the cursor to the `Output Heading` field and select it.
5. Using the list of characters in the `Choices` menu, enter a printout heading (optional). Select `Done` when the heading is complete.

Printing TESTS Screens

TESTS screens include:

- "Edit Configuration"
- "Edit Sequence"
- "Edit Frequency"
- "Edit Specifications"
- "Edit Parameters"

The same general process is used to print the information for all of the above TESTS screens.

1. Make sure that your printer is properly connected and configured as explained earlier in this section.
2. Press (TESTS).
3. Position the cursor to the `Test Function` field and select it.
4. From the `Choices` menu, select the `Edit` field screen you desire.
5. Press (K3) `Print All` and select it.
6. Press (TESTS) to return to the TESTS screen.

Procedures

A Procedure is a collection of parameters, specifications and a test sequence, saved in a file that customizes the test software to a specific application. You may save the file on a memory card or disk.

You do not have to save a test sequence in a procedure. Each test can be stand-alone if desired. After you choose a procedure, you can choose which of the TESTs you want to run.

When you save a procedure you will only be saving parameters, specifications and a sequence. The memory card or disk must also contain a library file. A library file contains the names of all of the parameters, specifications and tests that are in the Base Station Test Software. The library you use will be the library that is supplied with your software. When you save your procedure, the library will be automatically saved on the same card or disk.

The procedure(s) supplied with your software will be listed in the `Choices:` column when you select the `Procedure:` field. Procedures will be displayed if your software memory card is plugged in.

Making a Procedure

After you have set up the test software you can save the setup to an SRAM memory card, disk, or internal RAM memory by doing the following.

The memory card or disk you use must be initialized before its first use. See *Initializing a Memory Card* or *Initializing a Disk* in *Data Collection*. If you are using a disk drive, you may have to enter the `External Disk Specification` into the CONFIGURE screen. It will be used when the `Location` field on the TESTS screen is **`Disk`**.

To make a procedure:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `Proc Mngr`.
4. Position the cursor to the `Procedure` field and select it.
5. From the list of characters in the `Choices` menu, enter a filename. Filename must be nine characters or less. When filename is complete, position cursor to `Done` and select it.
6. Position the cursor to the `Location to Make or Delete` field and select it. From the `Choices` menu, select where you want to save the file (memory **`Card`**, **`RAM`** or **`Disk`**). The media must be initialized before a file can be saved. (see also *Initializing a Memory Card* in *Data Collection*). To initialize a RAM disk, see *Memory Cards/Mass Storage* in the Test Set's *User's Guide* .
7. If you selected `Card`, insert an initialized memory card into the slot on the Test Set's front-panel.
8. Verify that the card or other media is not write-protected. See *Memory Cards*.
9. Position the cursor to the `Comment for new procedure` field and select it. From the list of characters in the `Choices` menu, enter comments. When the comments are complete, position the cursor to `Done` and select it.

10. Position the cursor to the `Library for the new Procedure` field and select `Current` (Current underlined). The name of the Library is displayed on the TESTS screen.

11. Position the cursor to the `Program location for new Procedure` field and select it. From the `Choices` menu, choose memory `Card`, `ROM`, `RAM` or `Disk`. When a procedure is run, the test system will look in this location for a code file if it is not resident in the Test Set's battery-backed-up memory. This location will usually be the software memory card.

12. Position the cursor to the `Action` field and select `Make Procedure`. A procedure will be saved at the location you chose.

Loading a Procedure

A procedure can be loaded from storage media into the Test Set's battery-backed-up memory by doing the following.

To load a procedure:

1. Press (TESTS).
2. Position the cursor to the `Location` field and select it.
3. From the `Choices` menu, choose the desired location where the procedure is stored and select: memory `Card`, `ROM`, `RAM` or `Disk`.
4. Position the cursor to the `Procedure` field and select it.
5. From the `Choices` menu, choose the procedure file that you want to load.
6. Read the `Comment` field to ensure that the loaded procedure file is the one you want.

Deleting a Procedure

Procedures can be removed from an SRAM memory card, disk or RAM by doing the following.

To delete a Procedure:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `Proc Mngr`.
4. Position the cursor to the `Location to Make or Delete` field and select it.

5. From the `Choices` menu, select where you want to delete the file from: memory `Card`, `RAM` or `Disk`.
6. Position the cursor to the `Procedure` field and select it.
7. From the list of characters in the `Choices` menu, enter the filename to be deleted. (The filename must be nine characters or less). When the filename is entered, position the cursor to `Done` and select it.
8. Position the cursor to the `Action` field and select `Delete Procedure` .
9. Answer the question with (SHIFT) YES, if the entries are correct. The procedure will be deleted.

Securing a Procedure

After you have set up your test software with a sequence, parameters, and specifications, you may wish to secure it. This operation will prevent the viewing and changing of the sequence, parameters, and specifications. You can select the items you wish to secure or un-secure. An IBASIC ROM program is stored in the Test Set's firmware to do this.

You can secure the procedure that is supplied with the test software. It is shipped un-secured.

After you make a procedure, you can secure it.

To secure a Procedure:

1. Press (TESTS).
2. Position the cursor to the `Location` field and select it.
3. From the `Choices` menu, select `ROM`.
4. Position the cursor to the `Procedure` field and select it.
5. From the `Choices` menu, select `SECURE_IT`.
6. Press (K1) `Run Test`.
7. Select the location of the procedure you want to secure: (K1) memory `Card` or (K2) `RAM`.

Note

RAM refers to the RAM Disk memory within the Test Set. Before selecting RAM, you must initialize the RAM as a disk. See *RAM, Initializing RAM Disks* in this chapter.

---

8. Proceed with the on-line instructions. You may wish to secure only one of the items, such as specifications.
9. When you are prompted to enter the `pass number`, enter any sequence of numerals 0 through 9 using the DATA keypad. Enter 9 digits or less.

To un-secure a procedure:

To un-secure a procedure, you must know the password.

1. Press (TESTS).
2. Position the cursor to the `Location` field and select it.
3. From the `Choices` menu, select `ROM`.
4. Position the cursor to the `Procedure` field and select it.
5. From the `Choices` menu, select `SECURE_IT`.
6. Press (K1) `Run Test`.
7. Select the location of the procedure you want to un-secure: (K1) memory `Card` or (K2) `RAM`.
8. Enter the name of the procedure you wish to un-secure.
9. If the procedure has any item secured, you will be asked for the `pass number`.
10. Proceed with the on-line instructions. Select the items you wish to un-secure.
11. When you are prompted, enter the `pass number` using the DATA keypad.

RAM

RAM Disk is a section of internal memory that acts much like a flexible disk. Programs can be stored, re-stored, erased, and retrieved.

The RAM disk is partitioned into four separate volumes; 0-3. Each volume is treated as a separate 'disk'. You can also specify the size of each disk in 256-byte increments.

The four RAM disk volumes are designated **:MEMORY,0,0** to **:MEMORY,0,3**. For example, to catalogue the contents of RAM disk volume '0' from the **IBASIC Controller** screen, enter

```
CAT ":MEMORY,0,0"
```

Volume 0's contents can be viewed and loaded from the three screens mentioned at the beginning of this section. Volumes 1, 2, and 3 can *only* be accessed from the **IBASIC Controller**.

Note

RAM Disk Erasure

Any existing programs or formatting on RAM is erased if you use the `RAM_MNG` or `COPY_PL` ROM programs, or the **SERVICE** screen's `RAM Initialize` function.

Therefore, you should only use RAM disks for short-term storage of files.

Initializing RAM Disks

Each RAM disk volume must be initialized before it can be used. Volume 0 can be initialized using the RAM_MNG procedure stored on internal ROM. Volumes 1, 2, and 3 must be initialized from the **IBASIC Controller** screen.

The optional 'volume size' in the following procedure lets you specify the memory area set aside for each disk in 256 byte blocks.

Follow these steps to initialize volumes 1, 2, or 3:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `IBASIC`.
4. Position the cursor to the `Options` field and select it.
5. Using the list of characters from the `Choices` menu, enter the following command:

```
INITIALIZE ":MEMORY,0,<volume number 1-3>",<volume size>
   or
INITIALIZE ":MEMORY,0,1",50
```

Saving Tests Results

See Data Collection (Saving and Retrieving Test Results).

Sequence Editing

You can link one or more tests into a sequence. When the first test is finished, the next will run. You may find it preferable to have only one test in a sequence. You will be able to select the individual test that you want to run. After you load a procedure, you can edit the test sequence, and change the single test to the one you want to run. The sequence will remain in the Test Set's battery-backed-up memory.

The sequence can be secured. See *Securing a Procedure*.

To edit a test sequence:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `Edit Seq`.
4. If there is no test displayed in the top (or only) field in the column labeled `Test Name`, select the field in this column and choose any test from the `Choices` menu.
5. Press (K1)`Insrt Stp` until the sequence has as many steps as you want. When you press this key, the test in the displayed sequence that has its `Step #` highlighted (inverse video) will be copied into a new sequence location, immediately after the highlighted one. The tests that follow in the sequence will be scrolled down by one step. This key does nothing if there are no items in the sequence.
6. To replace the test that is in a particular step in the sequence with the TEST of your choice:
   a. Select the highlighted (inverse video) field in the column labeled `Step #`.
   b. Position the cursor to the step number you want to change and select it.

c. Position the cursor to the `Test Name` field and select it.

d. From the `Choices` menu, select the test you want at this step number.

- Press (K2) `Delet Stp` to delete a highlighted step in the sequence. When you press this key, the test in the displayed sequence that has its `Step #` highlighted (inverse video) will be deleted. The tests that follow in the sequence will be scrolled up by one step.
- If the sequence steps scroll past the bottom or top of the display, select the field in the column labeled `Step #` and rotate the knob to display all or part of the sequence.

Serial Port

This 6-pin, RJ-11 serial port is used to input and output serial data. Serial data is used for entering programs, printing, and for sending test results to a connected controller, disk drive, or terminal.

Operating Considerations

The serial communications settings are defined on the **I/O CONFIGURE** screen. Ground is used with both IBASIC and all other serial connections. Transmit B and Receive B are exclusively used with IBASIC programs. Transmit and Receive are used with all other serial connections (see Figure 5-1).

The IBASIC Controller sends data to and receives data from the serial ports using address **9** for the primary port, and address **10** for Port B.

Use an RJ-11/25-pin RS-232 adapter (HP P/N 98642-66508) and RJ-11 cable (HP P/N 98642-66505) to connect the HP 8921A to a serial printer or terminal/computer.

Note **RJ-11 Connectors**

RJ-11 cables and adapters can be wired several ways. If you buy a cable or adapter other than the HP parts listed, verify the connections for the pins indicated in the following table before connecting cables to the instruments.

The following table lists connections for Transmit, Receive, and Ground pins (address 9).

HP 8921A RJ-11 Serial Port		Terminal/PC 25-Pin RS-232		Terminal/PC 9-Pin RS-232
Pin 2 (RX)	to	pin 2 (TX)	or	pin 3 (TX)
Pin 5 (TX)	to	pin 3 (RX)	or	pin 2 (RX)
Pin 4 (GND)	to	pin 7 (GND)	or	pin 5 (GND)

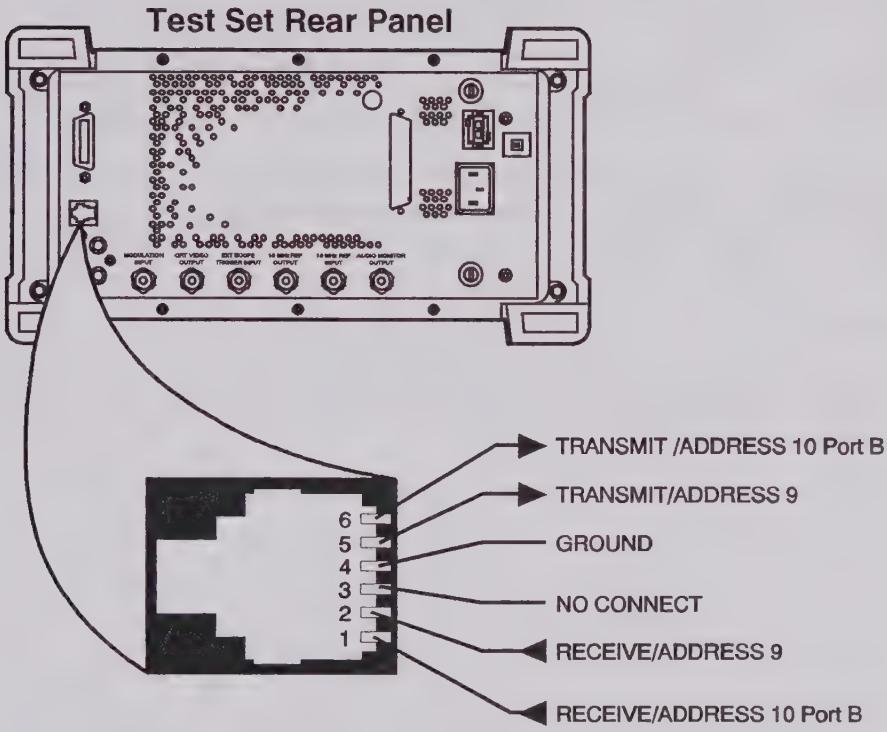


Figure 5-1. Test Set RJ-11 Serial Port Connections

Specifications

Specifications are values you enter that set passing limits for tests. Default values are available in the test software. They have been derived from standard methods of measurement or from Northern Telecom requirements.

Specifications do not have to be changed when you select a test or change the tests in your sequence. Each test has specifications that apply to it.

You should verify that specifications are properly set after you select the tests to be placed in your sequence. Lists of the specifications used by each of the tests are contained in *Test Descriptions* , chapter 4 of this manual. A lock is provided to prevent access to the test specifications. See *Securing a Procedure*.

Specifications remain in the Test Set's battery-backed-up memory until you select a procedure to run. If you wish to prevent specifications from being lost when a new procedure is selected, you will have to save them in a procedure. See *Making a Procedure*.

To print the specifications list, see *Printing TESTS Screens*

To edit a specification:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `Edit Spec`.
4. Position the cursor to the `Spec#` field and select it.
5. Rotate the knob to the desired specification number and select it.
6. Position the cursor to the `Lower Limit` or the `Upper Limit` field and select it.
7. Enter desired value using the DATA keypad and press (ENTER).
   a. Use the (←) key to backspace.
   b. Press (CANCEL) to cancel entries and retain the old value.
8. Position the cursor to the `Check` field and select it.
9. From the `Choices` menu, select the combination of upper and lower limits to be checked.

Test Execution Conditions

In some situations, you may wish to change the way the software works when a test result is obtained. `Test Execution Conditions` allow you to do this.

`Test Execution Conditions` are displayed on the TESTS screen. Press (TESTS) to display them.

`Test Execution Conditions` are not retained after a power-down/power-up cycle.

The following `Test Execution Conditions` can be set as needed:

On UUT Failure

You can select either: `Continue` or `Stop`
Default: `Continue`

If you set this to `Stop`, and a pass/fail result is F, the program will pause. You can repeat the measurement by pressing the (K1) `Repeat`. You can also do troubleshooting at this point by using (K5) `Laptop`. See TEST_040 *GN Laptop Emulator*.

Run Mode

You can select either: `Continuous` or `Single Step`
Default: `Continuous`

You can make tests pause at certain times. If you set this to `Single Step`, the program will pause after a comparison is made between a test determination and the expected result. For example, tests will pause after the program compares the results to a specification. You can continue from the paused state by pressing (K2) `Continue`.

Output Results

You can select either: `All` or `Failures`

Default: `All`

You can specify if you want only the failed results to be displayed or printed. This will be useful if you generally do not print test results, and want to ensure that failed results are displayed or printed.

Output Destination

You can select either: `Crt` or `Printer`

Default: `Crt`

You can specify where test results are to be placed. If you select `Crt`, results will be displayed on the Test Set's CRT. If you select `Printer`, test results will be sent to the CRT and to a printer. You must connect and configure a printer if you select `Printer`. See *Printing* in this chapter.

Output Heading Field

You can use this field to enter a heading that will be printed or displayed.

Select the `Output Heading` field. Use the knob to choose and enter the characters that you want to appear in the heading.

Choose `Done` when you are finished.

USER Keys

When you are using the Test Set, you will see the following USER keys assigned appear at times in the top right corner of the display. These keys are assigned to the hard keys (K1) through (K5). In many cases, these keys can be used as "shortcuts" instead of positioning the cursor and selecting. USER keys are sometimes referred to as softkeys.

Adj Power

This USER key can be used when testing a CRCU. When you press this key, the software will take you to the power setting keys.

Adj Limit

Limiting can be effected by audio adjustments. This USER key can be used to go back and check limiting adjustments when doing audio adjustments.

Align

This USER key should be used if the base station is commissioning, or has been in for repairs or start-up maintenance. If the base station is set up and has been in operation, there is no need for an alignment.

Chge Lev

This USER key appears in the meter screen during TEST_18 and TEST_19, *RX1(2) signal strength indicator* for CRCU testing only. RSSI must be adjusted at −90 and −40 dBm. The current level is displayed at the bottom of the screen. This USER key will allow the user to toggle the selection to the other level.

Clr Scr

This USER key clears the Test Set's CRT display. If you clear the screen and then continue the program, there may be an interconnect diagram partially displayed. Re-run the program to re-display the entire interconnect diagram.

Continue

This USER key continues the program after it has been paused. See *Exiting a Program* in chapter 5.

Delete Ch

This USER key is used during the editing of items in the TESTS(Edit Frequencies) list. When you press this key, the channel in the displayed list that has its Chan# highlighted (inverse video) will be deleted. The channels that follow in the sequence will be scrolled up by one.

Delet Stp

This USER key is used during the editing of items in a test sequence. When you press this key, the test in the displayed sequence that has its Step # highlighted (inverse video) will be deleted. The tests that follow in the sequence will be scrolled up by one step.

Disp Loc

When this key is pressed, the location of an adjustment will be graphically displayed on the Test Set's CRT display.

Done

Press this USER key if you want to accept the level displayed on the meter and continue with the program, or if you are finished with the present test and wish to move on to the next test in the sequence.

`Edit Seqn`

`Edit Freq`

`Edit Spec`

These keys can be used to quickly access a tests sub-screen. For example, when you press `Edit Seqn`, the tests `(Edit Sequence)` screen will be displayed. This sub-screen is used to enter one or more tests into a sequence.

These keys are not displayed while the program is running. To display these keys, pause the program by pressing the CANCEL key, then press the TESTS key.

`Insert Ch`

This USER key is used during the entry of items into the TESTS`(Edit Frequencies)` list. When you press this key, the item

in the displayed list that has its `Chan#` highlighted (inverse video) will be copied into a new location, immediately after the highlighted one. The items that follow in the sequence will be scrolled down by one.

`Insrt Stp`

This USER key is used during the entry of items into a test sequence. When you press this key, the test in the displayed sequence that has its `Step #` highlighted (inverse video) will be copied into a new sequence location, immediately after the highlighted one. The tests that follow in the sequence will be scrolled down by one step. This key does nothing if there are no items in the sequence. Choose a test before using this key to insert another.

Laptop

This USER key allows the user to send commands to the base station from their laptop. Press (K5) **Done** when finished sending commands, however the base station must be restored to its initial state to continue testing. Select (K1) **Yes** to return to laptop mode to restore the initial state, or select (K2) **No** to continue testing.

Page Up

Page Down

These USER keys move a selection list up and down in the Test Set's CRT display. They are used to quickly display items in the list when some of the items won't fit on the screen.

Print All

This USER key is displayed when the screens to edit test conditions are displayed, for example TESTS (**Edit Sequence**). The USER key can be used to print, using the Serial or HP-IB ports, the sequence, test channels, specifications, parameters, and configuration you have set up. The selected Procedure, Library, and date and time are printed at the top of the output. The **Print To** field on the CONFIGURE screen must be set to **Serial** or **HP-IB**, matching the type of printer you are using.

You may want to use this key to produce a printed record of the test setup conditions you have entered.

Repeat

This USER key may be used to repeat the previous measurement.

`Retest`

Pressing this key exits the adjustment procedure so that a measurement and display of the test can take place. If the re-test does not pass the program will re-display the meter so adjustment can continue.

`Return`

This USER key allows the user to return to the previous menu or screen.

`Run`

This USER key starts an IBASIC program that has been loaded into the Test Set memory. When you press this key you will not necessarily be running the program that results from the entries made into the `Procedure:` and `Location` fields on the TESTS screen. USER `Run Test` will run the program that results from the entries in the `Procedure:` and `Location` fields.

`Run Test`

This USER key loads and runs the program that results from the Procedure that has been entered into the TESTS screen `Procedure:` entry. If the program is already loaded into Test Set memory, it will be started. Changes you have made to the sequence or other TESTS screen entries will be used. If you have selected the `Procedure:` field and changed its contents, the TESTS screen conditions that are saved in the Procedure will be used.

`Sngl Step`

This USER key steps the IBASIC program one line at a time. This is different from `Continuous/Single Step` run mode. See *Test Execution Conditions*.

`Stop Test`

This USER key pauses the base station test software. It is equivalent to pressing the CANCEL key to pause the software. The program may be subsequently continued by pressing USER `Continue`.

`Tns Off`

`Tns Quiet`

`Tns Loud`

Audible tones give you feedback during the adjustment procedure. Use these keys to change the volume of the tones.

`Yes`

`No`

These USER keys are pressed when answering questions displayed on the Test Set's CRT.

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Problem Solving

This chapter contains problem modules and error messages. Problem modules alphabetically list the location of the problem with a brief symptom (e.g.. Test Set Doesn't Power Up). Each problem module describes possible causes and corrections. The error messages section is located at the end of the chapter and provides a brief description of the message as well as possible corrective actions.

If a problem persists, call the HP Factory Hotline from anywhere in the USA or Canada (1-800-922-8920, 8:30 a.m. - 5:00 p.m. Pacific time).

Note

If the Test Set displays an error that states "One or more self-tests failed", you have a hardware problem. In this case, refer to the Test Set's *Assembly Level Repair* manual.

Base Station Control Difficulties

- Check that the RS-232 and RJ-11 receive and transmit lines are properly wired.
- Verify all instruments are powered up.
- Verify that the RJ-11 cable has six wires and six connections.
- Only the Serial B port on the Test Set can be used for RCU control.
- Verify that the RS-232 cable is connected to the RJ-11 connector on the RCU or CRCU with the correct pin connections.

See *Making Connections* in chapter 2.

To monitor the messages sent to and from the base station, see *Logging* in chapter 5.

Data-Collection Function Does Not Work

- Check that you have `DATA C` entered as a `Calling Name` in the **TESTS (Edit Configuration)** screen.
- Check the `Model` field, it should be kept empty since it is not used.
- Check the `Addr` (address) field to make sure the correct address is entered for where the data is to be stored.
  - If data is to be stored on an SRAM memory card, enter "1" into the `Addr` field.
  - If data is to be stored on an external computer through the optional HP 8920A RS-232 serial port, enter "9" or "10" into the `Addr` field.
  - If data is to be stored on an external disk drive over HP-IB, enter the drive's three-digit HP-IB address into the `Addr` field.
- Check the `Options` field to make sure it is correctly set up for the type of file you want to create (BDAT, ASCII, DOS, HPUX), and the record size. Refer to chapter 5 - *Data Collection*.

External Switch Doesn't Switch

- Verify that you have made the correct entries to the TESTS (`Edit Configuration`) screen for the switch that you are using.
- Check the connections to the Test Set DB-37 connector.
- If you are using the Radio Interface Card, verify that the option is installed and properly connected to the external switches.

See *Making Connections* in chapter 2.

Memory Space Problems

The HP 11807B program uses a substantial amount of the Test Set RAM space. If you see a message that indicates a memory problem, check the memory space that has been used.

To determine the memory space used:

1. Load the program, if it is not already loaded, by pressing USER `Run Test` and waiting for the program display to appear.
2. Press (SHIFT) CANCEL to stop the program.
3. Press (DUPLEX) to exit the TESTS screen.
4. Press (SHIFT) SAVE.
5. Read the number in front of `free memory`.

If this number is a few percent or less, you may get an error message after saving additional set-ups to SAVE registers.

If you do not have sufficient memory space available, you may need to delete unnecessary save registers.

To delete save_recall registers:

1. Press (DUPLEX).
2. Press (RECALL).
3. Press (ON/OFF) to clear register.
4. Press the (ON/OFF) button again to answer YES.

Printing Problems

- Make sure the printer is turned on.
- Verify HP-IB or serial cable connections from the Test Set to the printer.
- Check that `Printer` was selected as the output destination in the **TESTS** screen, under `Test Execution Conditions`.
- Check that the Test Set is correctly configured for HP-IB or serial printing:

  For an HP-IB printer:

  1. Access the **TESTS (Edit Configuration)** screen and verify that the printer's "calling name" is `PRINTER` and its full 3-digit HP-IB address is correctly entered.

  For a serial printer:

  1. Access the **TESTS (Edit Configuration)** screen and verify that the printer's "calling name" is `PRINTER`, and that the address is set to 9 or 10 (depending on which of the two available serial port connections you are using).
  2. Check that the **I/O CONFIGURE** screen has been set up correctly using these fields: `Serial Baud`, `Parity`, `Data Length`, and `Stop Length`.

Test Results are Unexpected

If one or more tests fail unexpectedly, or you believe there is a problem with the way tests are running, check the settings that are used for the tests.

1. Press (TESTS).
2. Position the cursor to the **Run Mode** field (in Test Execution Conditions) and select **Single Step**.
3. From the **To Screen** menu, position the cursor to the desired screen and select it.
4. After viewing the appropriate settings, press (TESTS) to return to the TESTS screen.
5. Press (K2) **Continue**.

Test Set Doesn't Power Up

Check the AC or DC power connection and the setting of the AC/DC switch on the rear panel. See the Test Set's *User's Guide*.

Error Messages

Many error messages are coded into the Test Set firmware and test software. If the problem is related to Test Set operation, access the **MESSAGE** screen to see any messages that have occurred since the instrument was turned on. To do this, press the [SHIFT] then [RX].

Many of the error messages are listed below, alphabetically, with a description of the problem and possible corrections. If you see a message that is not described here, press [CANCEL], and then the [MSSG] key. Other related error messages may be displayed.

For a listing of additional error messages, see the Test Set's *User's Guide* and the *HP 8920A Instrument BASIC Programmer's Guide* (HP P/N 08920-90034).

If you see an error message that contains a program line number, and it is not listed in this section, please write down the message with the line number and call the factory at 1-800-922-8920.

Error Message Reference

Channel error. Range is 1 to 799 and 991 to 1023. Change channel number in the TESTS Edit Frequencies screen. Channel entries must be in this specified range.

- Enter channel numbers into the `RX Chan Info` field on the TESTS `(Edit Frequencies)`. screen.
- The last `RX Freq` entry must be `-1` to terminate the channel list.

Could not set desired SINAD in 20 tries
If the SINAD test is set to find the RF level at which the specified SINAD occurs, and is unable to find that RF level after 20 attempts, this message is printed.

- Verify that your REV audio is connected.
- Verify that the Test Set DUPLEX OUT is connected to the correct antenna.
- There may be a problem with the receiver in the radio.

Data collection address cannot be set to 10. Program stopped.
The second serial port in the Test Set has an address of 10. It is used for base station control. The Serial port, having an address of 9, can be used for data collection. If you are collecting data to an HP-IB device, you have to enter all three digits of the address. For additional information, see *Data Collection* in chapter 5.

Duplicate file. Over-write old file?
A file name can only be used once. The entered file name has the same name as one that is already stored on the storage media. If you answer **Yes** to Over-write old file?, the old file will be over-written. Once a file is over-written, it is unretrievable. There is no back-up.

Error 80 during Procedure catalog. Catalog aborted.
This message is displayed when the Test Set is unable to load a Procedure from a memory card.

- Check that the card is properly inserted and has Procedures saved on it.

ERROR 80 in (line number) Medium changed or not in drive Re- try?
This message is displayed when the Test Set is unable to receive valid files from a memory card.

- Check that the card is properly inserted and has Procedures saved on it.

Error in channel. Re-enter in RX Chan Info field.
If parameter *GN Channel [0=Single 1=Edit Freq 2=LCR]* is set to 1=`Edit Freq` or 2=`LCR`, the channels that are tested must be entered into the `RX Chan Info` field on the TESTS (`Edit Frequencies`) screen. This field is the lower field in the second column on the screen. Entry range is 1 to 799 and 991 to 1023.

Error in data collection information on cnfg screen.
This message is displayed if the file type or record number is not properly entered into the TESTS (`Edit Configuration`) screen.

To access the `Edit Configuration` screen:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `Edit Cnfg`.
4. Verify that the entries are correct.
   a. `Data C` should be entered in the `Calling Name` field.
   b. Check the entry in the `Addr` field. See the table in *Data Collection*, chapter 5 for the appropriate entries.

HP-IB Command not accepted. Option not installed.
This message may be displayed when the software tries to control a non-existent Radio Interface Card or non-existent other Test Set option.

- Check the Test Set rear panel for the Radio Interface connector.
  - If no Radio Interface connector is present, your test set does not have this option installed.
  - If a Radio Interface connector is present, check the LIST_OPTS program to verify that it is working properly.
  - If RADIO INTERFACE is not listed on the screen, the radio interface board may not be working properly.
  - If RADIO INTERFACE is listed on the screen and this error occurs, there may be an error in the software or firmware. Call the factory as 1-800-922-8920.

To check which options are installed in the Test Set:

Caution

Loading this program into the Test Set memory will erase any other programs and Procedures you have loaded. If you have not already done so, save your setups to a Procedure on an SRAM memory card before loading the "LIST_OPTS" program. See *Procedures* in chapter 2.

1. Press (TESTS).
2. Position the cursor to the `Location` field and select it.
3. From the `Choices` menu, select `ROM`.
4. Position the cursor to the `Procedure` field and select it.
5. From the `Choices` menu, select `LIST_OPTS`.
6. Press (K1) `Run Test` to display the installed options.
7. Check if RADIO INTERFACE is listed.

Error occurred at line ____
This message is displayed at the start of the testing sequence if a communication occurred between the base station and the test set.

- In some cases the software will try to recover from this error. If this is the case, you will be prompted to turn off the base station and press the USER `Continue` key.
- Check the control cables between the Test Set Serial Port and the base station DATA jack. Then try to run the test again.
- Turn the base station off, then run the test again.
- If the problem persists, there may be a problem with the software, the base station, or the test set. If you suspect a software or test set problem, call the HP factory at 1-800-922-8920.

Incorrect Audio Switch Model in Configuration screen. Program stopped.
or
Incorrect RF Switch Model in Configuration screen. Program stopped.
The software supports the use of the HP 8921A radio interface card, to control an external antenna switch, a splitter, or the HP 3488A Switch/Control Unit. Check the entries on the TESTS (`Edit Configuration`) screen. To access the `Edit Configuration` screen:

1. Press (TESTS).
2. Position the cursor to the `Test Function` field and select it.
3. From the `Choices` menu, select `Edit Cnfg`.
4. Verify that the entry in the `Model` field is correct. See the table in chapter 5, *Configuration* for appropriate entries.

No response from Base Station for ____
When a control command is sent to the base station a specific response is expected. If the response is not received this message will be displayed.

- Check the control cable between the Test Serial Port and the base station DATA jack.
- The control link between the test set and base station may be locked up. Reset the base station and restart the test.

Printer address cannot be set to 10.
The second Test Set serial port, Serial B, has an address of 10. It is used for base station control. The Serial port, having an address of 9, can be used for printing. If you are using an HP-IB printer, you need to enter all three digits of the printer address. See *Printing* in chapter 5.

The HP 8921A must be configured in Control Mode.
No other controllers may be on the HP-IB bus.
Do you want to put the HP 8921A in Control Mode?
Select desired softkey.
The Test Set can be set to operate in the HP-IB `Control` mode or the `Talk&Lstn` mode, using the I/O CONFIGURE screen. For this application, it must be set to `Control` mode.

Press the USER KEY `Yes` to automatically change the entry on the I/O CONFIGURE screen to `Control` mode.

Timeout error from an external instrument.
This message will be displayed if the Test Set tries to control a device on the HP-IB bus and is unable to do so for 5 seconds.

- Check that the HP-IB connectors are attached properly and are in working order.
- Verify that the HP-IB binary address switches are set properly.
- Verify entries made to the TESTS(`Edit Configuration`) screen `Addr` field match the address on the HP-IB address switch, and that it is an allowable address (see *Configuration* in chapter 5).

Timeout from HP 3488 at address (Address). Retry?

- Verify that the HP 3488 address switch is set properly.
- Verify entries made to the TESTS(`Edit Configuration`) screen `Addr` field match the address on the 3488 address switch, and that it is an allowable address (see *Configuration* in chapter 5).
- Verify that the HP-IB binary address switches are set properly.

Timeout from printer at address (printer address). Retry?

- Verify that the HP 3488 address switch is set properly.
- Verify entries made to the TESTS(`Edit Configuration`) screen `Addr` field match the address on the 3488 address switch, and that it is an allowable address (see *Configuration* in chapter 5).
- Verify that the HP-IB binary address switches are set properly.

Timeout on Logger @ (address)
If the software cannot log a RCU message within ten seconds, the program displays this error message.

- Check the entries in the TESTS (`Edit Configuration`) screen.
- If you are using an external device, check the cables, connections and address.

Unstable reading
In some tests the software continues to take measured readings until the readings agree with previous readings. This is done to make sure the measurement has settled. If the measurement has not settled after 10 tries, this message is printed. If this message happens occasionally there is probably nothing wrong. If it happens repeatedly, there may be a problem with the transceiver.

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A

Appendix A : Using the HP 3488A

The HP 3488A can be used to automatically switch the receiver inputs to the Test Set DUPLEX OUT. If you want to automatically switch these outputs to the Test Set RF IN/OUT connector, use the Radio Interface Card.

If you choose to use an HP 3488A Switch/Control Unit to automatically switch input ports to the Test Set DUPLEX OUT and AUDIO OUT connectors, one Option 15/HP 44476A Microwave switch unit must be installed.

Connect the switches as described in figure A-1. The first number in the switch identifier refers to the rear-panel switch row that it is located in. The last number refers to the switch column.

The TESTS (`Edit Configuration`) screen must contain entries that reflect the use of the HP 3488A. See *Configuration* in chapter 5 for the entries you must make.

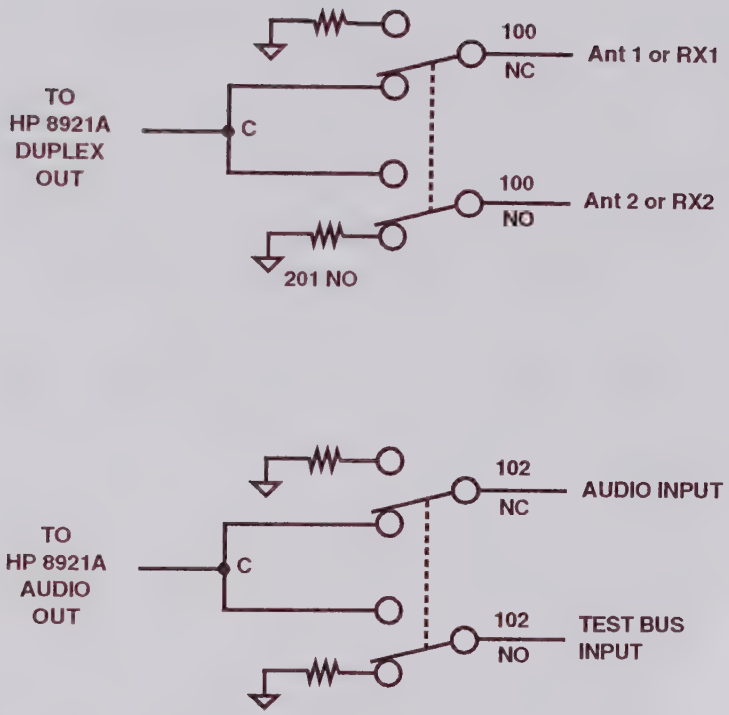

Figure A-1. HP 3488A Connections for 3488 Switch

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Glossary

AMPS
Advanced Mobile Phone Service - The cellular system in use on the North American continent and on other continents.

audio/logic
Refers to the audio/logic board in the CRCU.

BPF
Band Pass Filter. A filter that increasingly rejects signals as their frequency increases and decreases towards, and then is outside of certain cutoff frequencies. In the Test Set, audio band pass filters are used to reduce the level of out-of-band signals during certain measurements.

CANCEL
A key used to pause (stop) the IBASIC program running in the HP 8921A.

card
Refers to the memory card containing the procedures for testing the base station.

Choices
Refers to a field in the lower right of the HP 8921A screen that displays several possible functions for selection.

Continue
Proceed with the IBASIC software program if it has been stopped (paused).

CRCU
Compact Radio Channel Unit

cursor
Refers to the brightened region of the HP 8921A screen used to indicate the field/function currently being accessed.

`Del Step`
A function to delete a step in the procedure.

`Edit Cnfg` (configuration)
Title of an HP 8921A screen that allows you to set up (configure) printers, PCs, disks ...

`Edit Freq` (frequency)
Function which allows you to edit the values of the test frequencies.

`Edit Parm` (parameters)
Function which allows you to edit the values of the test parameters. See also "parameters".

`Edit Seqn`
The Edit Seqn feature allows you to select a single test and run it or to create your own sequence of tests.

`Edit Spec` (specifications)
Function which allows you to edit the limits of the test specifications. See also "specifications".

ESD
ElectroStatic Discharge - A transfer of electric charge from one place to another. Devices can be damaged by the energy transferred during the discharge.

field
An area on the CRT with an inverse video display (`example`) where entries can be made.

FP
Front Panel

function
Refers to a particular field, feature, or operation of the HP 8921A.

GN
Abbreviation for General. GN appears in some titles in the software and indicates that it relates to the general system, as opposed to a transmitter (TX) or receiver (RX).

HELP
A feature providing additional HP 8921A information accessed by pressing SHIFT, then TX (HELP) keys.

highlight
Refers to the brightened region (cursor) of the HP 8921A screen used to indicate the field/function currently being accessed.

HPF
High Pass Filter. A filter that increasingly passes signals as their frequency increases towards, and then is greater than, a certain cutoff frequency. In the Test Set, audio high pass filters are used to reduce the level of low frequency signals during certain measurements.

IBASIC
Instrument BASIC is the computer language (code or software) used by the HP 8921A built-in controller. The IBASIC software is downloaded from the HP 11807B OTP CARD into the HP 8921A RAM. This software is then used to control the HP 8921A during autotesting the base station.

initialize
A card or disk must be formatted prior to storing data.

ITL
Input Test Level

key (USER keys)

Keys refer to any of the push buttons on the front panel of the HP 8921A. The USER keys are a specific grouping of keys labeled [K1] to [K5] which perform the associated numbered function in the action field located in the upper right or the screen. The USER keys are user programmable.

knob

The large tuning dial for cursor control located in the center of the HP 8921A front panel. This knob is rotated to position the cursor on the screen and then pressed to select the particular field or function.

library

A collection of the names of all of the parameters, specifications, and tests in the test software. The test software and the Test Set's firmware use the library, test software program code file, and a procedure to run a customized application program. A library is stored as a file on a memory card or other mass storage with its associated procedure files.

LIL

Line Input Level

`Location`

Where to retrieve or save a particular testing procedure e.g., disk, CARD, RAM, PC, etc.

LOL

Line Output Level

LPF

Low Pass Filter. A filter that increasingly rejects signals as their frequency increases towards, and then is greater than, a certain cutoff frequency. In the Test Set, audio low pass filters are used to reduce the level of high frequency signals during certain measurements.

measurement

A series of calculations on data measured by the HP 8921A providing a value to be compared against specification HI/LO limit values to verify the performance of the base station.

menu

The HP 8921A screen displays various tasks to be selected with the cursor control knob or the USER keys ; this display is the menu.

message

The upper portion of the HP 8921A screen is reserved for messages and prompts. Messages give an indication of the status of the HP 8921A, e.g. **System initialization**.

OTL

Output Test Level

OTP

One Time Programmable (OTP) refers to a CARD on which code or date may only be stored once; similar to ROM. The HP 11807B software is shipped on an OTP memory card.

PA

Power Amplifier. The power amplifier is separate in the CRCU.

parameters

Entries you make for calibration data, cell site characteristics, or test customization. They give you flexibility in the way you use the HP 11807B software. Default values for parameters are entered into the software.

pause

Using the CANCEL key pauses the running of IBASIC software in the HP 8921A and allows access to the keyboard functions. CONTINUE allows the software to proceed.

peak+/- max

A detector in the Test Set that measures and computes the maximum of the absolute value of the positive and negative excursions of the measurement. For example, when an FM waveform with a +10 kHz and -9 kHz deviation is applied, 10 kHz will be displayed.

PRESET

Sets the HP 8921A to its initial power-up state.

procedure

A shortened label for test procedure. A procedure is a collection of channels, parameters, specifications, and a test sequence, saved in a file, that customizes the test software to a specific application. Procedures are made by editing existing channels, parameters, specifications, and sequence, and saving the resulting files to a memory card, disk or internal Test Set RAM. Procedure Manager (`Proc Mngr` Test Function) is used when making procedures. The field titled `Procedure` contains the name of the test procedure currently running in the HP 8921A.

prompts

The upper portion of the HP 8921A (inverse video field) is reserved for prompts and messages. The prompt directs the user to take some action. Messages give an indication of the status of the HP 8921A.

PS/RF

Refers to the Power Supply/RF board in the CRCU.

RAM

Random Access Memory - The memory in the Test Set that is used to store program code and data. The Test Set RAM is battery-backed-up, retaining data and program code when the power is turned off.

ROM

Read Only Memory

RSSI

Received Signal Strength Indicator - A level in a receiver that is related to the signal strength of the incoming signal.

Run Test

Directs the HP 8921A to load the program from the current procedure and begin testing (may take up to two minutes).

SAT

Supervisory Audio Tone - A 5970 Hz, 6000 Hz, or 6030 Hz sine-wave signal that frequency modulates an AMPS cell site voice channel transmitter. The signal is transponded by the mobile station and is used to help determine RF path integrity.

save

Save and store are used synonymously and refer to putting data or software on some memory device, e.g. CARD, RAM, etc.

screen

Refers to the video display of the HP 8921A.

select

To choose a particular field or function. Rotate the CURSOR CONTROL knob and position the highlighted cursor on the chosen field or function, then press the knob. An alternative method is to press the numbered USER key having the same number as displayed alongside the desired function.

sequence

The method used in the Test Set to run one or more TESTs in a desired order. A sequence is entered using the TESTS (`Edit Sequence`) screen.

SINAD

Signal plus Noise And Distortion divided by noise and distortion. A measurement result that determines the quality of an audio tone in the presence of noise and distortion. A 12 dB SINAD value is often used when measuring the receiver sensitivity.

softkey

The name of the set of keys next to the CRT display that can be assigned to certain special actions or fields. The keys are also called USER keys.

specifications

Specifications are the names of criteria verifying the performance of the base station. The specification value may be changed by using the `Edit Spec` function. Usually the associated measurement value must fall within the HI/LO limits of specification values to verify performance of the base station. Default values in the test software have been derived from standard methods of measurements or from the base station requirements.

SRAM
Static Random Access Memory - A data storage device. SRAM memory cards can be used with the Test Set to save programs and test results.

ST
Signaling Tone. Refers to a 10 kHz tone that the mobile sends to the base station when certain signaling operations must occur.

Step#
Orders the sequence of tests, e.g. Step #1 may be Test_5, and Step #2 may be Test_26, etc.

store
Store and save are used synonymously and refer to putting data or software on some memory device, e.g. CARD, RAM, etc.

Test Function
A field, in the lower left corner of the tests screen that provides the editing features: Edit_Seqn, Edit_Freq, Edit_Parm, Edit_Cnfg, Proc_Mgr, and IBASIC.

tests
Tests are a collection of measurements (or a series of other tests) which verify a particular specification value or operation of the base station. A sequence of tests are contained in a test procedure.

TESTS Screen

The screen accessed by pressing the [TESTS] key. It is used to set-up and perform all base station testing.

USER keys

A group of keys located immediately to the right of the HP 8921A screen that allow the user to more rapidly select certain functions without rotating and pressing the knob. These key assignments are displayed in the upper right portion of the HP 8921A screen. The number on the left of the function corresponds to the number on the user key [k1] to [k5].

values

The scaler quantities or numbers inserted in the inverse video fields of the specifications or parameters. Units of measure (dB, inches, volts, watts, etc.) are contained in the specifications and parameters.

VSWR

Voltage Standing Wave Ratio - A ratio that quantifies the level of reflected power that results from the application of forward power to a transmission line. A VSWR of 1:1 exists on a transmission line terminated in its characteristic impedance.

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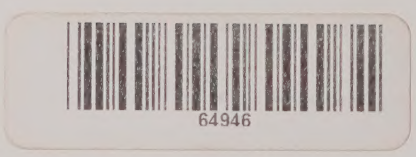

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